



# राजपत्र, हिमाचल प्रदेश (असाधारण)

हिमाचल प्रदेश राज्य शासन द्वारा प्रकाशित

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शिमला, शुक्रवार, 10 मार्च, 2006/19 फाल्गुन, 1927

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हिमाचल प्रदेश सरकार

वन विभाग

अधिसूचना

शिमला-171002, 3 मार्च, 2006

संख्या एफ० एफ० ई०-ए(बी) 1-3/98.—हिमाचल प्रदेश के राज्यपाल, भारत के संविधान के अनुच्छेद-309 के परन्तुक द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए हिमाचल प्रदेश लोक सेवा आयोग के परामर्श से हिमाचल प्रदेश, वन विभाग में इस अधिसूचना से संलग्न उपाबन्ध- "अ" के अनुसार वन परिक्षेत्र

अधिकारी, वर्ग-II (राजपत्रित) के पद के भर्ती एवं प्रोन्नति नियम बनाते हैं, अर्थात्:-

## 1. संक्षिप्त नाम और प्रारम्भ

1. इन नियमों का संक्षिप्त नाम हिमाचल प्रदेश, वन विभाग, वन परिक्षेत्र अधिकारी, वर्ग-II (राजपत्रित) भर्ती एवं प्रोन्नति नियम, 2006 है।

2. ये नियम राजपत्र, हिमाचल प्रदेश में प्रकाशित किए जाने की तारीख से प्रवृत्त होंगे।

## 2. निरसन और व्यावृत्तियां

1. वन विभाग की अधिसूचना संख्या एफटीएस. (बी) 2-5/76-II दिनांक 15-11-1978 द्वारा अधिसूचित और समय-समय पर संशोधित वन विभाग, वन राजिक, श्रेणी-III (अराजपत्रित) के भर्ती एवं प्रोन्नति, नियम 1966 को एतद्वारा निरसन किया जाता है।

2. ऐसे निरसन के होते हुए भी उपर्युक्त उप-नियम 2(1) के अधीन इस प्रकार निरसित सुसंगत नियमों के अधीन की गई कोई नियुक्ति, बात या कार्यवाही, इन नियमों के अधीन विधिमान्य रूप में की गई, समझी जाएगी।

आदेश द्वारा,

हस्ताक्षरित/-  
प्रधान सचिव (वन)।

उपाबन्ध-"अ"

वन विभाग, हिमाचल प्रदेश में वन परिक्षेत्र अधिकारी, वर्ग-II (राजपत्रित), पद के भर्ती एवं प्रोन्नति नियम

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|--|---|--|
| 1. पद का नाम                             | : | वन परिक्षेत्र अधिकारी                  |
| 2. पदों की संख्या                        | : | 297 (दो सौ सत्तानवें)                  |
| 3. वर्गीकरण                              | : | वर्ग-II (राजपत्रित)                    |
| 4. वेतनमान (विस्तृत रूप में अंकित करें)। | : | 5800-200-7000-220-8100-275-9200 रुपये। |
| 5. चयन अथवा अचयन पद                      | : | चयन पद                                 |



8. सीधी भर्ती हेतु आयु

: 21 वर्ष से 26 वर्ष।

परन्तु यह कि सीधी भर्ती के लिए ऊपरी आयु सीमा, तदर्थ या संविदा आधार पर नियुक्त किए गए पहले से सरकार की सेवा में नियुक्त व्यक्तियों सहित अभ्यर्थियों के लिए 42 वर्ष होगी:

परन्तु यह और कि यदि तदर्थ आधार पर नियुक्त किया गया अभ्यर्थी इस रूप में नियुक्ति की तारीख को अधिक आयु का हो गया हो, तो यह तदर्थ या संविदा के आधार पर नियुक्ति के कारण विहित आयु में छूट के लिए पात्र नहीं होगा:

परन्तु यह और कि अनुसूचित जातियों/अनुसूचित जन जातियों तथा अन्य वर्गों के व्यक्तियों के लिए उच्चतम आयु सीमा में उतनी ही छूट दी जा सकेगी, जितनी कि हिमाचल प्रदेश सरकार के साधारण या विशेष आदेशों के अधीन अनुज्ञेय है:

परन्तु यह और भी कि पब्लिक सैक्टर, निगमों तथा स्वायत्त निकायों के सभी कर्मचारियों को, जो ऐसे पब्लिक सैक्टर, निगमों तथा स्वायत्त निकायों के प्रारम्भिक गठन के समय ऐसे पब्लिक सैक्टर, निगमों/स्वायत्त निकायों में आमेदन से पूर्व सरकारी कर्मचारी थे, सीधी भर्ती में आयु सीमा में ऐसी ही रियायत दी जायेगी जैसी सरकारी कर्मचारियों को अनुज्ञेय है, किन्तु इस प्रकार की रियायत पब्लिक सैक्टर, निगमों द्वारा स्वायत्त निकायों के ऐसे कर्मचारीवृन्द को नहीं दी जायेगी जो पश्चात्पूर्व ऐसे निगमों/स्वायत्त निकायों द्वारा नियुक्त किए थे/किए गए हैं और उन पब्लिक सैक्टर/निगमों/स्वायत्त निकायों के प्रारम्भिक गठन के पश्चात् ऐसे निगमों/स्वायत्त निकायों की सेवा में अन्तिम रूप से आमेलित किए गए हैं/थे।

1. सीधी भर्ती के लिए आयु सीमा की गणना उस वर्ष के प्रथम दिवस से की जाएगी जिसमें कि पद (पदों) का यथास्थिति, आवेदन आमंत्रित करने के लिए विज्ञापित किया जाता है या नियोजनालयों को अधिसूचित किया जाता है।
2. अन्यथा सूचित अभ्यर्थियों की दशा में सीधी भर्ती के लिये आयु सीमा और अनुभव आयोग के विवेकानुसार शिथिल किया जा सकेगा।

7. सीधी भर्ती किए जाने वाले व्यक्तियों के लिए अपेक्षित न्यूनतम शैक्षणिक और अन्य अर्हताएं। (क) अनिवार्य अर्हताएं:-1. अभ्यर्थी किसी मान्यता प्राप्त विश्वविद्यालय से निम्नलिखित विषयों में से कम से कम एक विषय सहित स्नातक या इसके समकक्ष हो:-

कृषि, कृषि इंजिनियरिंग, सस्य-विज्ञान, पशुपालन एवं पशु चिकित्सा विज्ञान, वनस्पति विज्ञान, रसायन इंजीनियरिंग, सिविल इंजीनियरिंग, अर्थशास्त्र, वन विज्ञान-I, वन विज्ञान-II, भू-विज्ञान, उद्यान विज्ञान, गणित, यांत्रिक इंजिनियरी, भौतिक-विज्ञान, पौध-विज्ञान, संवर्धन, पौध-रोग विज्ञान, मृदा-विज्ञान, सांख्यिकी, प्राणी-विज्ञान तथा भूगोल:

परन्तु यह कि, उन स्नातकों की दशा में, जिन्होंने शुद्ध गणित, सांख्यिकी या अर्थशास्त्र सहित स्नातक की परीक्षा पास की हो, उनके द्वारा 10+2 या समकक्ष परीक्षा विज्ञान विषय सहित पास होनी अनिवार्य है:

परन्तु यह और कि सामान्य वर्ग के अभ्यर्थी परीक्षा में बैठने के छः अवसर प्राप्त कर सकते हैं। अनुसूचित जाति/अनुसूचित जनजाति/अन्य पिछड़ा वर्ग के अभ्यर्थियों के लिए इस प्रकार की कोई सीमा नहीं होगी:

परन्तु यह और कि जो कोई सरकारी कर्मचारी हिमाचल प्रदेश में अविच्छाद्य/स्थानापन्न नियुक्ति पर है, परीक्षा में बैठने का पात्र होगा यदि वह किसी मान्यता प्राप्त विश्वविद्यालय से ऊपर-वर्णित विषयों में से कम से कम एक विषय सहित स्नातक या समकक्ष हो तो सामान्य वर्ग के अभ्यर्थी की दशा में छः अवसर के अध्यधीन तथा अनुसूचित जाति/अनुसूचित जन जाति/अन्य पिछड़ा वर्ग के अभ्यर्थी की दशा में इस प्रकार की किसी सीमा के बिना पात्र होगा। ये अवसर अभ्यर्थी द्वारा सीधी भर्ती की दशा में प्राप्त किए गए अवसर सहित होंगे।

परन्तु यह और कि केवल वही अभ्यर्थी जो लिखित परीक्षा में अर्हित होने हैं, को शारीरिक परीक्षण के लिए बुलाया जाएगा और शारीरिक परीक्षण हेतु बुलाए जाने वाले अभ्यर्थियों की संख्या रिक्तियों की संख्या का पांच गुणा होगी।

## 2. शारीरिक मापदण्ड:

### पुरुषों के लिए:

कद	:	165 सेंटी मीटर
छाती	:	79 सेंटी मीटर बिना फुलाए तथा 84 सेंटी मीटर फुला कर।
पैदल चलने की क्षमता	:	चार घण्टे में 25 किलो मीटर।

### महिलाओं के लिए :

कद	:	150 सेंटी मीटर
छाती	:	74 सेंटी मीटर बिना फुलाए तथा 79 सेंटी मीटर फुला कर।
पैदल चलने की क्षमता	:	चार घण्टे में 14 किलो मीटर।

अनुसूचित जन जाति के अभ्यर्थियों की बाबत शारीरिक मापदण्ड में कद में 5 सेंटी मीटर तथा सीना फुलाकर तथा बिना फुलाए, दोनों दशाओं में, 4 सेंटी मीटर की छूट दी जाएगी।

## 3. स्वास्थ्य प्रमाण-पत्र:

प्रशिक्षण के लिए चयनित अभ्यर्थियों का केन्द्रीय सिविल सेवाएं विनियम के अनुच्छेद-19 द्वारा विहित प्रारूप पर अनुपूरक नियमों के तत्स्थानी नियम के तहत सम्यक रूप से गठित चिकित्सा बोर्ड द्वारा जारी चिकित्सा प्रमाण-पत्र प्रस्तुत करना होगा, जिसमें यह प्रमाणित किया गया हो कि 'अभ्यर्थी की श्रवण-शक्ति स्वस्थ है तथा सामान्य शारीरिक योग्यता वन विभाग में विषम बाह्य कार्य के अनुरूप है।

अभ्यर्थी द्वारा सम्बन्धित जिले के चिकित्सा अधिकारी या समतुल्य अधिकारी द्वारा जारी चिकित्सा प्रमाण-पत्र प्रस्तुत करना अपेक्षित होगा।

## (ख) वांछनीय अर्हताएं:

हिमाचल प्रदेश की रूढ़ियों, रीतियों और बोलियों का ज्ञान और प्रदेश में विद्यमान विशिष्ट दशाओं में नियुक्ति के लिए उपयुक्तता।

8. सीधी भर्ती किये जाने वाले व्यक्तियों : लागू नहीं  
के लिए विहित आयु और  
शैक्षणिक अर्हताएं पदोन्नति की दशा  
में लागू होगी या नहीं।
9. परीक्षा की अवधि, यदि कोई हो : दो वर्ष, जिसका एक वर्ष से अनधिक ऐसी और अवधि के  
लिए विस्तार किया जा सकेगा जैसा राक्षम प्राधिकारी विशेष  
परिस्थितियों में और लिखित कारणों से आदेश दें।
10. भर्ती की पद्धति : (क) 45 प्रतिशत सीधी भर्ती द्वारा 55 प्रतिशत प्रोन्नति  
द्वारा:  
भर्ती सीधी होगी या प्रोन्नति या  
प्रतिनियुक्ति या स्थानान्तरण द्वारा  
और विभिन्न पद्धतियों द्वारा भरे  
जाने वाली पदों की प्रतिशतता।
- परन्तु यह कि सीधी भर्ती कोटे के अन्तर्गत आने वाले 70  
प्रतिशत पदों को केवल वानिकी में विज्ञान स्नातकों में से भरा  
जाएगा तथा शेष 30 प्रतिशत पदों को उन अभ्यर्थियों में से भरा  
जाएगा, जिन्होंने स्नातक की परीक्षा निम्नलिखित विषयों में से  
किसी एक विषय सहित उत्तीर्ण की हो:-

कृषि, कृषि इंजिनियरिंग, सस्य-विज्ञान, पशुपालन एवं  
पशु चिकित्सा विज्ञान, वनस्पति विज्ञान, रसायन इंजीनियरिंग,  
सिविल इंजीनियरिंग, अर्थशास्त्र, वन विज्ञान-I, वन  
विज्ञान-II, भू-विज्ञान, उद्यान विज्ञान, गणित, यांत्रिक  
इंजीनीयरी, भौतिक-विज्ञान, पौध-विज्ञान, पौध संवर्धन,  
पौध-रोग विज्ञान, मृदा-विज्ञान, सांख्यिकी, प्राणी-विज्ञान  
तथा भूगोल।

(ख) वन अनुसंधान संस्थान एवं महा-विद्यालय, देहरादून  
या किसी अन्य स्थान पर प्रशिक्षण के लिए चयनित अभ्यर्थी प्रशिक्षण  
के दौरान सरकार द्वारा समय-समय पर नियत दर पर उपस्कर भत्ते  
वृत्तिका के संदाय के हकदार होंगे।

11. प्रोन्नति, प्रतिनियुक्ति या स्थानान्तरण की दशा में श्रेणियां जिनसे प्रोन्नति, प्रतिनियुक्ति या स्थानान्तरण किया जाएगा।

(i) उप वन राजिकों में से, जिनका 8 वर्ष का नियमित सेवाकाल या ग्रेड में की गई लगातार तदर्थ सेवा यदि कोई हो, सहित, रायुक्त नियमित सेवाकाल हो, 52 प्रतिशत प्रोन्नति द्वारा।

(ii) स्नातक विज्ञान (वानिकी) वन रक्षकों, जिन्होंने 10 वर्ष का नियमित सेवाकाल या ग्रेड में की गई सेवा सहित संयुक्त नियमित सेवा की हो, में से 1 ½% प्रोन्नति द्वारा और प्रोन्नत स्नातक विज्ञान (वानिकी) उप वन राजिकों, जिन्होंने ग्रेड में की गई तदर्थ सेवा सहित संयुक्त सेवा की हो में से 1 ½% प्रोन्नति द्वारा।

सीधी भर्ती तथा विभिन्न सम्भरण प्रवर्गों में से प्रोन्नति द्वारा पद भरने के लिए रोस्टर उपाबन्ध-“आ” से उपाबद्ध किया गया है।

1. प्रोन्नति के सभी मामलों में, पद पर नियमित नियुक्ति से पूर्व सम्भरण पद में की गई निरन्तर तदर्थ सेवा, यदि कोई हो, प्रोन्नति के लिए इन नियमों में यथाविहित सेवाकाल के लिए, इस शर्त के अधीन रहते हुए गणना में ली जाएगी, कि सम्भरण प्रवर्ग में तदर्थ नियुक्ति/प्रोन्नति, भर्ती एवं प्रोन्नति नियमों के उपबन्धों के अनुसार चयन की उचित स्वीकार्य प्रक्रिया को अपनाने के पश्चात् की गई थी। परन्तु यह कि

(क) उन सभी मामलों में जिनमें कोई कनिष्ठ व्यक्ति सम्भरण पद में अपने कुल सेवाकाल में (तदर्थ आधार पर की गई तदर्थ सेवा सहित, जो नियमित सेवा/नियुक्ति के अनुसरण में हो, को शामिल करके) के आधार पर उपर्युक्त निर्दिष्ट उपबन्धों के कारण विचार किए जाने का पात्र हो जाता है, वही अपने प्रवर्ग/पद/फीडर में उससे वरिष्ठ सभी व्यक्ति विचार किए जाने के पात्र माने जाएंगे और विचार करते समय कनिष्ठ व्यक्ति से ऊपर रखे जाएंगे।

परन्तु यह कि उन सभी पदधारियों की जिन पर प्रोन्नति के लिए विचार किया जाना है, कम से कम तीन वर्ष की न्यूनतम अर्हता सेवा या पद के भर्ती एवं प्रोन्नति नियमों में विहित सेवा, जो भी कम हो, होगी।

परन्तु यह और कि जहां कोई व्यक्ति पूर्वगामी परन्तुक की अपेक्षाओं के कारण प्रोन्नति किए जाने सम्बन्धी विचार के लिए पात्र हो जाता है, वहां उससे कनिष्ठ व्यक्ति भी ऐसी प्रोन्नति के विचार के लिए अपात्र समझा जाएगा/समझे जाएंगे।

**स्पष्टीकरण**— अंतिम परन्तुक के अन्तर्गत कनिष्ठ पदधारी प्रोन्नति के लिए अपात्र नहीं समझा जाएगा/समझे जाएंगे यदि वरिष्ठ अपात्र व्यक्ति भूतपूर्व सैनिक है जिसे डिमोबिलाईज्ड आर्मड फोर्सिज परसोनल (रिजर्वेशन आफ वैकेन्सीज इन हिमाचल स्टेट नॉन टैक्नीकल सर्विसिज) रूलज, 1972 के नियम-3 के प्रावधानों के अन्तर्गत भर्ती किया गया हों तथा इनके अन्तर्गत वरीयता लाभ दिए गए हों या जिसे एक्स-सर्विसमैन (रिजर्वेशन आफ वैकेन्सीज इन दी हिमाचल प्रदेश टैक्नीकल सर्विसिज) रूलज, 1985 के नियम-3 के प्रावधानों के अन्तर्गत भर्ती किए गए हो तथा इनके अन्तर्गत वरीयता लाभ दिए गए हों।

(2) इस प्रकार स्थाईकरण के सभी मामलों में ऐसे पद पर नियुक्ति से पूर्व सम्भरण पद पर की गई तदर्थ सेवा, यदि कोई हो, सेवाकाल के लिए गणना में ली जाएगी, यदि ऐसे प्रोन्नति नियमों के उपबन्धों के अनुसार की गई थी:

परन्तु यह कि उपर्युक्त निर्दिष्ट तदर्थ सेवा को गणना में लेने के पश्चात् जो स्थाई करण होगा उसके फलस्वरूप पारम्परिक वरीयता अपरिवर्तित रहेगी।

12. यदि विभागीय प्रोन्नति समिति विद्यमान हो तो उसकी संरचना।

विभागीय प्रोन्नति समिति की अध्यक्षता अध्यक्ष, हिमाचल प्रदेश लोक सेवा आयोग के अध्यक्ष या उनके द्वारा नाम निर्दिष्ट सदस्य द्वारा की जाएगी।

13. भर्ती करने में जिन परिस्थितियों में हिमाचल प्रदेश लोक सेवा आयोग से परामर्श किया जायेगा।

जैसा कि विधि द्वारा अपेक्षित है।

14. सीधी भर्ती किए जाने वाले व्यक्तियों के लिय आवश्यक अपेक्षा।

किसी सेवा या पद पर नियुक्ति के लिए अभ्यर्थी का भारत का नागरिक होना अनिवार्य है।

15. सीधी भर्ती द्वारा पद पर नियुक्ति के लिए चयन।

प्रशिक्षण/नियुक्ति के लिए अभ्यर्थी का चयन हिमाचल प्रदेश लोक सेवा आयोग द्वारा नियमों के साथ उपाबन्ध परिशिष्ट के अनुसार विहित पाठ्य विवरण के आधार पर ली जाने वाली लिखित परीक्षा तथा अभ्यर्थी के लिखित तथा मौखिक परीक्षा में प्रदर्शन को विचार में रखते हुए किया जाएगा।

16. आरक्षण : उक्त सेवा में नियुक्ति, हिमाचल प्रदेश सरकार द्वारा समय-समय पर अनुसूचित जातियों/अनुसूचित जन जातियों/पिछड़े वर्ग और अन्य प्रवर्ग के व्यक्तियों के लिए सेवा में आरक्षण की बाबत जारी किये गये आदेशों के अधीन होगी।
17. विभागीय परीक्षा : सेवा में प्रत्येक सदस्य को समय-समय पर यथा संशोधित विभागीय परीक्षा नियम, 1997 में यथा विहित विभागीय परीक्षा उत्तीर्ण करनी होगी।
18. शिथिल करने की शक्ति : जहां राज्य सरकार की यह राय हो कि ऐसा करना आवश्यक या समीचीन है, वहां यह कारणों को अभिलिखित करके और हिमाचल प्रदेश लोक सेवा आयोग के परामर्श से आदेश द्वारा इन नियमों के किन्हीं उपबन्धों को किसी वर्ग या व्यक्तियों के प्रवर्ग या पदों की बाबत शिथिल कर सकेगी।

उपबन्ध—“आ”

वन परिक्षेत्र अधिकारी के पद हेतु नियुक्ति रोस्टर (कुल पद = 297)

सीधी भर्ती द्वारा	:	45 प्रतिशत = 134
प्रोन्नति द्वारा	:	55 प्रतिशत = 163
विज्ञान स्नातक (वानिकी)।	:	32 प्रतिशत = 94
उप वन राजिक	:	52 प्रतिशत = 154
स्नातक	:	13 प्रतिशत = 40
उप वन राजिक एवं वन रक्षक, जिन्होंने विज्ञान स्नातक (वानिकी) में उपाधि प्राप्त की हो।	:	3 प्रतिशत (प्रत्येक को 1½%) = 09

उप वन राजिक

1, 2, 3, 5, 6, 9, 11, 12, 14, 17, 18, 19, 21, 24, 25, 27, 28, 31, 33, 36, 37, 40, 41, 43, 44, 47, 49, 50, 53, 55, 56, 57, 59, 62, 63, 65, 66, 71, 72, 73, 76, 78, 79, 81, 84, 85, 87, 88, 91, 92, 94, 95, 98, 100, 103, 106, 107, 109, 110, 111, 114, 116, 117, 120, 122, 123, 125, 128, 129, 130, 132, 133, 138, 139, 142, 144, 145, 146, 148, 151, 152, 154, 155, 158, 160, 161, 164, 165, 168, 170, 173, 174, 176, 177, 180, 182, 183, 184, 187, 189, 190, 192, 195, 196, 198, 199, 203,

	205, 206, 209, 211, 212, 214, 217, 218, 219, 221, 222, 225, 227, 228, 231, 233, 236, 239, 240, 243, 244, 247, 249, 250, 253, 255, 256, 258, 259, 261, 264, 265, 268, 270, 273, 274, 276, 277, 280, 282, 283, 284, 287, 289, 290, 292, 295.
विज्ञान स्नातक (वानिकी)	4, 7, 10, 13, 16, 20, 23, 26, 29, 32, 35, 39, 42, 46, 48, 51, 54, 58, 61, 64, 69, 70, 74, 77, 80, 83, 86, 90, 93, 96, 101, 102, 105, 108, 113, 115, 118, 121, 124, 127, 131, 136, 137, 140, 143, 147, 150, 153, 157, 159, 162, 166, 169, 172, 175, 179, 181, 185, 188, 191, 194, 200, 202, 204, 207, 210, 213, 216, 220, 224, 226, 229, 232, 235, 238, 241, 242, 246, 248, 251, 254, 257, 260, 263, 266, 269, 272, 275, 279, 281, 285, 288, 291, 294.
स्नातक	8, 15, 22, 30, 38, 45, 52, 60, 68, 75, 82, 89, 97, 104, 112, 119, 126, 135, 141, 149, 156, 163, 171, 178, 186, 193, 201, 208, 215, 223, 230, 237, 245, 252, 267, 271, 278, 286, 293, 296.
उप वन राजिक विज्ञान स्नातक (वानिकी)।	67, 134, 197, 262.
वन रक्षक विज्ञान स्नातक (वानिकी)	34, 99, 167, 234, 297
विज्ञान स्नातक (वानिकी)	
रोस्टर में दर्शाए गए बिन्दुओं द्वारा एक बार जब सभी प्रवर्गों को प्रतिनिधित्व प्राप्त होगा, तत्पश्चात् रिक्ति को उसी प्रवर्ग से भरा जाएगा, जिस प्रवर्ग द्वारा पद रिक्त हुआ है।	
पाठ्य विवरण	: प्रवेश परीक्षा निम्नलिखित प्रश्न-पत्रों के रूप में होगी।

### अनिवार्य प्रश्न-पत्र

#### 1. सामान्य ज्ञान

सामान्य ज्ञान से सामयिक घटनाओं की जानकारी तथा वैज्ञानिक पहलुओं की दृष्टि से ऐसे दैनिक संप्रेक्षण व अनुभव के विषयों की जानकारी शामिल है, जो एक ऐसे शिक्षित व्यक्ति से अपेक्षित है, जिसने वैज्ञानिक विषय का विशेष अध्ययन नहीं किया हो। प्रश्न-पत्र में भारतीय राजनीति पर भी प्रश्न होंगे, जिसमें राजनीतिक पद्धति, भारत का संविधान, भारत का इतिहास तथा प्रकृति का भूगोल सम्मिलित होंगे, जिन्हें अभ्यर्थी बिना किसी विशेष अध्ययन के उत्तर देने में समर्थ होंगे।

...100 अंक

#### 2. सामान्य अंग्रेजी

प्रश्न पत्र की परिकल्पना अभ्यर्थी की शुद्ध तथा मुहावरेदार अंग्रेजी लिखने की शक्ति की समझ का निर्धारण करना है। इसमें अभ्यर्थी के व्याकरण मुहावरे तथा वाक्य-प्रयोग सम्बन्धी ज्ञान को परखने के लिए



प्रश्न सम्मिलित होंगे। इसके अतिरिक्त प्रादेशिक, राष्ट्रीय या अन्तर्राष्ट्रीय घटनाओं पर आधारित सामयिक विषयों पर एक निबन्ध होगा। निबन्ध 20 अंकों का सारांश 20 अंकों का तथा अन्य 50 अंकों का होगा।

...100 अंक

### 3. हिन्दी

1. राज्य/राष्ट्रीय/अन्तर्राष्ट्रीय घटना क्रमों के सामयिक विषयों पर निबन्ध	...30 अंक
2. एक अंग्रेजी अंश का हिन्दी में अनुवाद	...10 अंक
3. हिन्दी गद्यांश और पद्यांश की उसी भाषा में व्याख्या	...20 अंक
4. गुहावरे/शुद्धियां/व्यापकार्य तथा व्याकरण आदि	...40 अंक
<b>कुल अंक</b>	<b>100 अंक</b>

### वैकल्पिक विषय:

कृषि, कृषि इंजिनियरिंग, रसायन-विज्ञान, पशुपालन एवं पशु चिकित्सा विज्ञान, वनस्पति विज्ञान, रसायन इंजीनियरिंग, सिविल इंजीनियरिंग, अर्थशास्त्र, वन विज्ञान-I, वन विज्ञान-II, भू-विज्ञान, उद्यान विज्ञान, गणित, यांत्रिक इंजीनियरी, भौतिक-विज्ञान, पौध-विज्ञान, संवर्धन, पौध-रोग विज्ञान, मृदा-विज्ञान, सांख्यिकी, प्राणी-विज्ञान तथा भूगोल।

अभ्यर्थियों को उपरोक्त विषयों में से दो विषय चुनने होंगे। वैकल्पिक विषयों में कुल प्रश्नों की संख्या 8 होगी। प्रत्येक प्रश्न के बराबर अंक होंगे। प्रत्येक प्रश्न-पत्र के 2 भाग होंगे अर्थात् भाग-I तथा भाग-II तथा प्रत्येक भाग में 4 प्रश्न होंगे। 8 प्रश्नों में से 5 प्रश्न हल करने होंगे। शेष 6 प्रश्नों में से प्रत्येक भाग में कम से कम 1 प्रश्न हल करते हुए अभ्यर्थियों को 3 और प्रश्नों के उत्तर देने होंगे। इस प्रकार प्रत्येक भाग से कम से कम 2 प्रश्नों को हल करना होगा, अर्थात् 1 अनिवार्य प्रश्न तथा एक अन्य प्रश्न।

टिप्पणी 1 : इन विषयों में, परीक्षा का स्तर स्नातक डिग्री के स्तर का होगा।

टिप्पणी 2 : कोई भी अभ्यर्थी निम्नलिखित दोनों विषयों को एक साथ नहीं चुन सकेंगे, अर्थात्-कृषि तथा कृषि इंजीनियरिंग, रसायन विज्ञान तथा रसायन, इंजीनियरिंग या गणित तथा सांख्यिकी।

टिप्पणी 3 : अनिवार्य विषयों में परीक्षा का स्तर 10+2, माध्यमिक या समतुल्य स्तर का होगा।

### साक्षात्कार तथा चयन:

हिमाचल प्रदेश सेवा आयोग उन अभ्यर्थियों के लिए साक्षात्कार का संचालन करेगा, जो शारीरिक मानक परीक्षण तथा लिखित परीक्षा में योग्यता के आधार पर अर्हता प्राप्त करते हैं। साक्षात्कार के लिए बुलाए जाने वाले अभ्यर्थियों की कुल संख्या कुल रिक्तियों का तीन गुणा होगी। अभ्यर्थियों का साक्षात्कार आयोग द्वारा लिया जाएगा, जिनके समक्ष उनका वृत्ति-अभिलेख होगा। साक्षात्कार का उद्देश्य राज्य वन सेवा के लिए अभ्यर्थियों की वैयक्तिक उपयुक्तता का निर्धारण करना है। परीक्षण का आशय अभ्यर्थियों के मानसिक व्यास को आंकना है। मोटे तौर पर यह अभ्यर्थियों के न केवल बौद्धिक गुणों, बल्कि उनके सामाजिक लक्षणों तथा सामयिक घटनाओं में रुचि का भी वास्तविक निर्धारण करता है। न्यायनिर्णय करने के लिए कुछ गुण होंगे अर्थात् मानसिक दक्षता, समीकरण, परिचर्या तथा तर्कसम्मत स्पष्टीकरण की समालोचनात्मक शक्तियां, विवेकबुद्धि का संतुलन, रुचियों के प्रकार तथा गहनता, समाजिक संलग्नता तथा नेतृत्व की योग्यता, बौद्धिक तथा नैतिक सत्यनिष्ठा। ...100 अंक

*[Authoritative English Text of this Department Notification No. FFE-A(B)1-3/98 dated 3-3-2006 as required under clause(3) of Article 348 of the Constitution of India].*

## FORESTS DEPARTMENT

### NOTIFICATION

*Shimla-171002, the 3rd March, 2006*

No. FFE-A(B)1-3/98.—In exercise of the powers conferred by proviso to Article 309 of the Constitution of India, the Governor, Himachal Pradesh in consultation with the Himachal Pradesh Public Service Commission is pleased to make the Recruitment and Promotion Rules for the post of Range Forest Officer, Class-II (Gazetted) in the Department of Forest, Himachal Pradesh as per Annexure-A attached to this notification, namely:—

1. Short title and Commencement : (1) These Rules shall be called the Himachal Pradesh Forest Department, Range Forest Officer, Class-II (Gazetted) Recruitment and Promotion Rules, 2006.
- (2) These Rules shall come into force from the date of publication in the Rajpatra, Himachal Pradesh.
2. Repeal and Savings : (1) The R&P Rules in respect of H. P. Forest Department Forest Ranger, Class-III (Non-Gazetted) notified *vide* notification No. Fts. (B)2-5/76-II dated 15-11-1978 certain other conditions of Service Rules, 1966 and as amended from time to time are hereby repealed.
- (2) Notwithstanding such repeal, any appointment made or anything done or any action taken under the relevant rules so repealed under sub-rule 2(1) *supra* shall be deemed to have been validly made or done or taken under these rules.

*By order*

*Sd/-*  
*Principal Secretary.*

ANNEXURE-A

### RECRUITMENT AND PROMOTION RULES FOR THE POST OF RANGE FOREST OFFICER, CLASS-II (GAZETTED) IN THE HIMACHAL PRADESH FOREST DEPARTMENT

- |    |                |                                     |
|----|----------------|-------------------------------------|
| 1. | Name of Post   | Range Forest Officer                |
| 2. | Number of Post | 297 (Two Hundred and Ninety Seven)  |
| 3. | Classification | Class-II (Gazetted)                 |
| 4. | Scale of pay   | Rs. 5800-200-7000-220-8100-275-9200 |

5. Whether selection post  
or non selection post. Selection

6. Age for direct recruitment 21 to 26 years:

Provided that the upper age limit for direct recruitment shall be 42 years for the candidates already in service of the Government including those who have been appointed on *ad hoc* or on contract basis.

Provided further that if a candidate appointed on *ad hoc* or contract basis had become overage on the date when he/she was appointed as such he/she shall not be eligible for any relaxation in the prescribed age limit by virtue of his/her such *ad hoc* or contract appointment:

Provided further that upper age limit is relaxable for Scheduled Castes/Scheduled Tribes/other categories of persons to the extent permissible under the general or special order(s) of the Himachal Pradesh Government:

Provided further that the employees of all the Public Sector Corporations and Autonomous Bodies who happened to be Government servants before absorption in Public Sector Corporations/autonomous bodies shall be allowed age concession in direct recruitment as admissible to Government servants. This concession will not, however, be admissible to such staff of the Public Sector Corporations/autonomous bodies who were/are subsequently appointed by such Corporation/autonomous bodies and who are/were finally absorbed in the service of such Corporations/autonomous bodies after initial Constitution of the Public Sector Corporations/Autonomous Bodies:—

1. Age limit for direct recruitment will be reckoned on the first day of the year in which the post(s) is/are advertised for inviting applications or notified to the Employment Exchanges or as the case may be.
2. Age and experience in the case of direct recruitment relaxable at the discretion of the Himachal Pradesh Public Service Commission in case the candidate is otherwise well qualified.

7. Minimum educational and other qualification required for direct recruits. (A) Essential qualifications.—(i) A candidate must possess at least Bachelor's degree of any recognised University or its equivalent with atleast one of the subjects :—

Agriculture, Agriculture Engineering, Agronomy, Animal Husbandry and Veterinary Science, Botany, Chemistry,

Chemical Engineering, Civil Engineering, Economics, Forestry-I, Forestry-II, Geology, Horticulture, Mathematics, Mechanical Engineering, Physics, Plant Anatomy, Plant Breeding, Plant Pathology, Soil Science, Statistics, Zoology & Geography :

Provided that in case of graduates with pure Mathematics, Statistics or Economics they must have taken Science subject in their 10+2 or equivalent examination :

Provided further that candidates belonging to General categories can avail 6 chances to appear in the examination. There shall be no limit for the candidates belonging to SCs/STs/OBCs categories :

Provided further that a Government servant who is holding substantive/officiating appointment in Himachal Pradesh shall be eligible to appear in the examination if he possess at least Bachelor's degree of any recognised university or equivalent with atleast one of the above mentioned subjects, subject to 6 chances in case if candidates belonging to general category and with no limit for SCs/STs/OBCs candidates. These chances will be inclusive of chances they might have availed as a direct candidate :

Provided further that only those candidates who qualify the written test will be called for the physical test and the number of candidates called for physical test will be five times the number of vacancies.

## (ii) PHYSICAL STANDARD

### Male

Height : 165cms  
Chest : 79 cms without expansion & 84 cms with expansion.  
Capacity to walk : 14 kms in 4 hours

### Female

Hight : 150 cms  
Chest : 74 cms without expansion & 79 cms with expansion.  
Capacity to walk : 14 kms in 4 hours

Physical Standards in respect of Scheduled Tribe Candidates shall be relaxable upto 5 cms in height and 4 cms in each in respect of chest without and with expansion.

(iii) **Health Certificate.**—The candidates selected for training shall have to produce Medical Certificate issued by a duly constituted Medical Board in the form prescribed by Article 19 of the Central Civil Services Regulation of the corresponding rule in the Supplementary rules testifying to the candidates sound hearing and general physical fitness for rough outdoor work in the Forest Department.

Candidates will be required to produce medical certificate issued by the medical officer or equivalent authority of the district concerned.

(B) **Desirable Qualification.**—knowledge of customs manner and dialects of Himachal Pradesh and suitability for appointment in the peculiar conditions prevailing in the Pradesh.

8. Whether age and educational qualification prescribed for direct recruits will apply in the case of promotees.

Not Applicable

9. Period of probation, if any

Two years subject to such further extension for a period not exceeding one year as may be ordered by the competent authority in special circumstances and reasons to be recorded in writing.

10. Method of recruitment—whether by direct recruitment or by promotion, deputation, transfer and the percentage of posts to be filled in by various matters.

(a) 45% by direct recruitment and 55% by promotion :

Provided that 70% posts falling under direct recruitment quota shall be filled up from amongst B.Sc (Forestry) Graduates only and remaining 30% posts shall be filled up from amongst the graduate candidates having one of the following subject :—

Agriculture, Agriculture Engineering, Agronomy, Animal Husbandry and Veterinary Science, Botany, Chemistry, Chemical Engineering, Civil Engineering, Economics, Forestry-I, Forestry-II, Geology, Horticulture, Mathematics, Mechanical Engineering, Physics, Plant Anatomy, Plant Breeding, Plant Pathology, Soil Science, Statistics, Zoology & Geography.

(b) The candidates selected for training at Forest Research Institute and College, Dehradun or at any other place, shall while undergoing the training be entitled to receive payment toward equipment allowance and stipend at the rates as may be fixed by the Government from time to time.

11. In case of recruitment by promotion, deputation transfer grade from which promotion/deputation/transfer is to be made.

(i) 52% by promotion from amongst Dy. Rangers having 8 years regular service or regular combined with continuous *ad hoc* service, if any, rendered in the grade.

(ii) 1½ % by promotion from amongst the Forest Guards who are B.Sc. (Forestry) with 10 years of regular service combined with continuous *ad hoc* service and 1½ % from amongst the promoted Dy. Rangers who possesses the degree of B.Sc. (Forestry) combined with continuous *ad hoc* service, if any, rendered in the grade.

The roster for filling up the post by direct recruitment and by promotion from amongst the different feeder categories is annexed as Annexure-R.

(i) In all cases of promotion the continuous *ad hoc* service rendered in the feeder post, if any, prior to regular appointment to the post shall be taken into account towards the length of service as prescribed in these rules for promotion subject to the condition that the *ad hoc* appointment/promotion in the feeder category had been made after following proper process of selection in accordance with the provisions of R&P Rules provided that:—

(a) that in all cases where a junior person becomes eligible for consideration by virtue of his/her total length of service (including the service rendered on *ad hoc* basis followed by regular service/appointment) in the feeder post in view of the provision referred to above all persons senior to him/her in the respective category/post/cadre shall be deemed to be eligible for consideration and placed above the junior person in the field of consideration :

Provided that all incumbents to be considered for promotion shall possess the minimum qualifying service of at least three years or that prescribed in the R&P Rules for the post which ever is less :

Provided further that where a person becomes ineligible to be considered for promotion on account of the requirements of the preceding proviso, the person(s) junior to him/her shall also be deemed to be ineligible for consideration for such promotion.

**Explanation—** The last proviso shall not render the junior incumbent(s) ineligible for consideration for promotion if the senior ineligible person(s) happened to be Ex-serviceman recruited under the provision of Rule 3 of Demobilized Armed Forces Personnel (Reservation of Vacancies in Himachal Pradesh State Technical Services) Rules, 1972 and having been given the benefit of seniority

thereunder or recruited under the provisions of Rule 3 of Ex-serviceman (Reservation of Vacancies in the Himachal Pradesh Technical Services) Rules, 1985 and having been given the benefit of seniority thereunder.

(2) Similarly, in all cases of confirmation, *ad hoc* service rendered on the feeder post, if any, prior to the regular appointment/promotion against such post shall be taken into account towards the length of service, if the *ad hoc* appointment/promotion had been made after proper selection and in accordance with the provision of the R&P Rules :

Provided that *inter-se* seniority as a result of confirmation after taking into account, *ad hoc* service rendered as referred to above shall remain unchanged.

12. If a Departmental Promotion Committee exists, what is its composition.

DPC to be presided over by the Chairman, H. P. Public Service Commission or a member thereto, to be nominated by him.

13. Circumstances under which the HPPSC is to be consulted in making recruitment.

As required under the Law

14. Essential requirement for direct recruitment.

A candidate for appointment to any service or post must be a citizen of India.

15. Selection for appointment to post by direct recruitment.

Selection of the candidate for training/appointment shall be made by the H. P. Public Service Commission on the basis of written test as per prescribed syllabus annexed as per Appendix to the rules and after taking into account the performance of the candidate in the written test and *viva-voce* test.

16. Reservations

The appointment to the service shall be subject to orders regarding reservation in the service for Scheduled Castes/Scheduled Tribes/other backward classes/other categories of persons issued by the Himachal Pradesh Government. from time to time.

17. Departmental Examination

Every member of the service shall pass a departmental Examination as prescribed in the H.P. Departmental Examination Rules, 1997 as amended from time to time.

18. Powers of relax

Where the State Government. is of the opinion that it is necessary or expedient to do so, it may, by order for reasons to be recorded in writing and in consultation with the HPPSC relax any of the provision(s) of these rules with respect to any class or category of person(s) or post(s).

## Appointment roster for the post of Range Forest Officer

### TOTAL POSTS—297

Direct	45%	=	134
Promote	55%	=	163
B.Sc. (Forestry)	32%	=	94
Dy. Ranger	52%	=	154
B.Sc.	13%	=	40
Dy. Ranger & Pts. Guards who possess B.Sc. (Forestry) Degree	3% (1½% of each)	=	9

### Deputy Ranger

1, 2, 3, 5, 6, 9, 11, 12, 14, 17, 18, 19, 21, 24, 25, 27, 28, 31, 33, 36, 37, 40, 41, 43, 44, 47, 49, 50, 53, 55, 56, 57, 59, 62, 63, 65, 66, 71, 72, 73, 76, 78, 79, 81, 84, 85, 87, 88, 91, 92, 94, 95, 98, 100, 103, 106, 107, 109, 110, 111, 114, 116, 117, 120, 122, 123, 125, 128, 129, 130, 132, 133, 138, 139, 142, 144, 145, 146, 148, 151, 152, 154, 155, 158, 160, 161, 164, 165, 168, 170, 173, 174, 176, 177, 180, 182, 183, 184, 187, 189, 190, 192, 195, 196, 198, 199, 203, 205, 206, 209, 211, 212, 214, 217, 218, 219, 221, 222, 225, 227, 228, 231, 233, 236, 239, 240, 243, 244, 247, 249, 250, 253, 255, 256, 258, 259, 261, 264, 265, 268, 270, 273, 274, 276, 277, 280, 282, 283, 284, 287, 289, 290, 292, 295.

### B.Sc. (Forestry)

4, 7, 10, 13, 16, 20, 23, 26, 29, 32, 39, 35, 42, 46, 48, 51, 54, 58, 61, 64, 69, 70, 74, 77, 80, 83, 86, 90, 93, 96, 101, 102, 105, 108, 113, 115, 118, 121, 124, 127, 131, 136, 140, 143, 147, 150, 153, 157, 159, 162, 166, 169, 172, 175, 179, 181, 185, 188, 191, 194, 200, 202, 204, 207, 210, 213, 216, 220, 224, 226, 229, 232, 235, 238, 241, 242, 246, 248, 251, 254, 257, 260, 263, 266, 269, 272, 275, 279, 281, 285, 288, 291, 294.



Graduates 8, 15, 22, 30, 38, 45, 52, 60, 68, 75, 82, 89, 97, 104, 112, 119, 126, 135, 141, 149, 156, 163, 171, 178, 186, 193, 201, 208, 215, 223, 230, 237, 245, 252, 267, 271, 278, 286, 293, 296.

Dy. Ranger 67, 134, 197, 262  
(B.Sc. Forestry).

Forest Guards 34, 99, 167, 234, 297  
(B.Sc. Forestry).

Once the representation to all categories is achieved by the given point in the roster, thereafter the vacancy is to be filled up from the category which vacates the post.

**Syllabus:** The entrance examination shall consist of given papers as follows:

### COMPULSORY PAPERS

#### 1. General Knowledge

General knowledge including knowledge of current events and of such matters of every day observation experience in their scientific aspects as is expected from an educated person who has not made special study of any scientific subject. The paper will also include questions on Indian Polity including the political system and the Constitution of India, History of India and Geography of nature which the candidate should be able to answer without special study.

100 marks

#### 2. General English

The question paper will be designated to assess the candidate's understanding of his power to write English correctly and idiomatically. It will also include questions to test the candidates knowledge of grammar, idiom and usage. Passages will be set for summary or precis. Besides there will be an essay on current topics on State, National, International events. The essay will carry 30 marks summary or precis 20 marks and other shall be of 50 marks.

100 marks

#### 3. Hindi

- (i) Essay on current topics on State/National/International event. 30 marks
- (ii) Translation of an English Passage into Hindi 10 marks
- (iii) Explanation of Hindi Prose and Poetry in the same language 20 marks
- (iv) Idioms/corrections/comprehension and grammar etc. 40 marks

100 Marks

**4. Optional Subjects :**

Agriculture, Agriculture Engineering, Agronomy, Animal Husbandry and Veterinary Science, Botany, Chemical Engineering, Chemistry, Civil Engineering, Economics, Forestry-I & II, Geology, Horticulture, Mathematics, Mechanical Engineering, Physics, Statistics, Zoology, Plant Breeding, Plant Pathology, Soil Science, Geography, Plant Anatomy.

Candidates are required to offer two of the above subject, total number of questions in the question papers of optional papers will be eight. All questions will carry equal marks. Each paper will be divided into two parts viz. Part-I and Part-II and each part shall contain four questions. Out of eight questions, five questions are to be attempted. One question from each part will be compulsory. The candidates will be required to answer three other questions out of the remaining six questions taking at least one question from each Part. In this say atleast two question will be attempted from each Part *i.e.* one compulsory question plus one more.

200 marks each subject

**Note-I** The standard of examination in these subjects will be that of a Bachelor's degree.

**Note-II** No candidate shall be allowed to take both the optional subjects *i.e.* Agriculture and Agriculture Engineering, Chemistry and Chemical Engineering or Mathematics and Statistics.

**Note-III** The standard of examination for compulsory papers will be 10+2 intermediate or equivalent level.

**5. Interview and Selection:**

The Himachal Pradesh Public Service Commission will conduct an interview of those candidates who shall qualify the physical standard test and written examination on merit basis. Total number of candidates called for interview will be three time of total vacancies. The candidates will be interviewed by the commission who will have before them a record of their career. The object of the interview is to assess the personal suitability of the candidate for the State Forest Service. The test is intended to judge mental caliber of the candidate. In broad terms this is really an assessment not only of candidate's intellectual qualities but also his social traits and interest in current affairs. Some of the qualities to be adjudged are mental alertness, critical powers of assimilation and logical exposition, balance of judgement Variety & depth of interests, ability for social cohesion & leadership, intellectual and moral integrity. 100 marks

ANNEXURE-C

**Syllabus for Competitive Examination for Ranger Forest Officer (Class-II Gezzetted)**

Candidates to the post of Range Forest Officer will be selected on the basis of a competitive examination to be conducted by Himachal Pradesh Public Service Commission as follows:—

**Written Examination:**

- |   |           |
|---|-----------|
| 1. General knowledge (emphasis on Environment, Ecology, Wildlife) | 100 marks |
| 2. English (Essay and Précis writing etc.)                        | 100 marks |
| 3. Hindi  | 100 marks |

4. Optional Paper : Candidates are required to offer any two of the following subjects (Subject to Note 3 above):

200 marks each

- Agriculture
- Agriculture Engineering
- Agronomy
- Animal Husbandry and Veterinary Science
- Botany
- Forestry-I (Section-A) Silviculture, Forest Ecology & Ethnobotany, Environmental conservation U Biodiversity, Tree improvement, Seed technology and Biotechnology, Forest Pathology, Entomology, Wildlife.
- Forestry-II (Section-A) Social, Agro and Farm Forestry, Joint Forest Management, Forest Resource & Utilization, Non-Timber Forest Produces, Marketing and Trade of Forest Produce. (Section-B) Forest Economics, Forest Policy & Legislation, Extension & Education, Communication, Project Planning, Monitoring & Evaluation.
- Chemistry
- Geology
- Mathematics
- Physics
- Plant Anatomy
- Plant Breeding
- Plant Pathology
- Soil Science
- Statistics
- Zoology
- Chemical Engineering
- Civil Engineering
- Mechanical Engineering
- Economics
- Horticulture
- Geography

## AGRICULTURE

### SECTION-A:

Ecology and its relevance to man. Natural resources, their management and conservation. Physical and social environment as factors of crop distribution and production. Climatic elements as factors of crop growth, impact of changing environment on cropping pattern, plants as indicators of environments. Environmental pollution and associated hazards to crops, animals and humans.

Cropping patterns in different agro-climatic zones of the country— impact of high yielding and short duration varieties on shifts in cropping patterns. Concepts and principles of multiple cropping—multistory, relay and inter-cropping and their importance in relation to food production. Package of practices for production of important cereals, pulses, oilseeds, fiber, sugar and commercial crops grown during Kharif and Rabi seasons in different regions of the country.

Weeds, their characteristics, dissemination and association with various crops, their multiplication, cultural, biological, chemical and integrated control of weeds.

Processes and factors of soil formation, classification of Indian soils including modern concepts, mineral and organic constituents of soil and their role in maintaining soil productivity. Problem soils, extent and distribution in India and their reclamation. Essential plant nutrients and other beneficial elements in soils and plants, their occurrence, factors affecting their distribution, availability functions and recycling in soils, symbiotic and non symbiotic nitrogen fixation. Principles of soil fertility and its evaluation for judicious fertilizer use.

Watershed management, Soil Conservation planning on watershed basis. Erosion and run off management in hilly, foot-hills and valley lands-processes and factors affecting them. Dry lands agriculture, its problems and crop production techniques.

Water use efficiency in relation to crop production, criteria for scheduling irrigation, ways and means of reducing run off losses of irrigation water.

Farm management, scope, importance and characteristics, farm planning and budgeting Economics of different types of farming systems.

Agriculture extension—its importance and role, extension techniques, methods of evaluation of extension programmes, socio-economic survey and status of big, small and marginal farmers training programs for extension workers. Training and extension programs.

#### SECTION-B:

Heredity and variation, Mendel's Law of inheritance, Chromosomal theory of inheritance. Cytoplasmic inheritance, Quantitative characters.

Origin and domestication of field crop. Morphology and patterns of variations in varieties and related species of important field crops. Causes and utilization of variations in crop improvement.

Application of the principles of plant breeding to the improvement of major field crops, methods of breeding of self and cross pollinated crops. Introduction, selection, hybridization, heterosis and its exploitation. Male sterility and self-incompatibility, utilization of mutation and polyploidy in breeding.

Seed and seed technology, importance, types and seeds and their production, processing and testing of seeds of crops and seed certification regulation.

Climatic requirements and cultivation of major fruits, plants and vegetable crops with special reference to commercial fruits and vegetables, the package of practices and the scientific basis for same. Handling and Marketing problems of fruits and vegetables, principal methods of preservation of important fruits and vegetable products, processing techniques and equipment. Role of fruits and vegetables in human nutrition, land scape and floriculture, including raising of ornamental plants and design and layout of lawns and gardens.

Diseases and pests of fields, vegetable, orchard and plantation crops of India and measures to control these. Causes and classification of plant diseases. Principles of plant disease control including exclusion, eradication, immunization and production. Biological control of pests and diseases. Integrated

management of pests and diseases. Pesticides and their formulations, plant protection equipment, their care and maintenance.

*Growth and development of vegetable crops.*—Physiology of dormancy and germination of vegetable seeds and tubers. Tissue Culture techniques.

*Post-Harvest Technology.*—Maturity and ripening process and factors affecting them. Quality evaluation for fresh market and processing. Factors responsible in deterioration of harvested fruits and vegetables, role of growth substances and eradication in decay control, respiration and transpiration, storage of fresh fruits and vegetables, theories of chilling injury and symptoms of chilling injured. Modified Gas storage.

## AGRICULTURE ENGINEERING

### SECTION-A:

1. *Soil and Water Conservation.*—Scope of soil and water conservation. Mechanics and types of erosion, their causes. Rainfall, runoff and sedimentation relationships and their measurement. Soil erosion control measures—biological and engineering including stream bank protection—vegetative barriers, contour bunds, contour trenches, contour stone walls, contour ditches, terraces, outlets and grassed waterways. Gully control structures—temporary and permanent, design of permanent soil conservation structures such as chute, drop and ponds. Principles of flood control—flood routing. Watershed Management—investigation, planning and implementation, selection of priority areas and watershed work plan, water harvesting and moisture conservation. Land development—leveling, estimation of earth volumes and costing. Wind erosion process—design of shelter belts and wind brakes and their management. Forest (Conservation) Act.

2. *Irrigation and Drainage.*—Sources of water for irrigation. Planning and design of minor irrigation projects. Techniques of measuring soil moisture—laboratory and *in situ*. Soil water plant relationships. Water requirement of crops, planning conjuncture use of surface and ground water. Measurement of irrigation water, measuring devices—orifices, weirs and flume. Methods of irrigation—surface, sprinkler and drip, fertigation. Irrigation efficiencies and their estimation. Design and construction of canals, field channels, underground pipelines head gates, diversion boxes and structures for road crossing. Occurrence of ground water, hydraulics of wells, types of wells (tube wells and open wells) and their construction. Well development and testing. Pumps—types, selection and installation. Rehabilitation of sick and failed wells. Drainage—causes of water logging and salt problem. Methods of drainage—drainage of irrigated and unirrigated lands, design of surface, sub-surface and vertical drainage systems. Improvement and utilization of poor quality water. Reclamation of saline and alkali soils. Economics of irrigation and drainage systems. Use of waste water for irrigation—standards of waste water for sustained irrigation, feasibility and economics.

3. *Agricultural structure.*—Site selection, design and construction of farmstead—farm house, cattle shed, dairy barn, poultry shed, hog housing, machinery and implement shed storage structures for food grains, feed and forage. Design and construction of fences and farm roads. Structures for plant environment—green houses, poly houses and shade houses. Common building materials used in construction—timber, brick stone, tiles, concrete etc. and their properties, water supply, drainage and sanitation system.

## SECTION-B:

4. **Agricultural, mechanisation and its scope.** Sources of farm power—animate and electro-mechanical. Thermodynamics, construction and working of internal combustion engines. Fuel, ignition, lubrication, cooling and governing system of IC engines. Different types of tractors and power tillers. Power transmission, ground drives, power take off p.t.o. and control systems. Operation and maintenance of farm machinery for primary and secondary tillage. Traction theory, Sowing, transplanting and inter cultural implements and tools. Plant protection equipment—spraying and dusting. Harvesting, Threshing and combining equipment. Machinery for earth moving and land development—methods and cost estimation. Ergonomics and man machine system. Machinery for horticulture and agro-forestry feeds and forages. Haulage of agricultural and forest produce.

5. **Agro-energy.**—Energy requirements of agricultural operations and agro-processing. Selection, installation, safety and maintenance of electric motors for agricultural applications. Solar (thermal and photovoltaic), wind and bio-gas energy and their utilization in agriculture. Gassification of biomass for running IC engines and for electric power generation. Energy efficient cooking stoves and alternate cooking fuels. Distribution of electricity for agricultural and agro-industrial applications.

6. **Agricultural Process Engineering.**—Post harvest technology of crops and its scope. Engineering properties of agricultural products and by-products. Unit operation—clearing grading, size reduction, densification, concentration drying/dehydration, evaporation, filtration, freezing and packaging of agricultural produces and by-products. Material handling equipment—belt and screw conveyors, bucket elevators, their capacity and power requirement.

Processing of Milk and dairy-products- homogenization, cream separation pasteurization, sterilization, spray and roller drying, butter making, ice cream, cheese and shrikhand manufacture. Waste and by-product utilization—rice husk, rice bran, sugar can bagasse, plant residues and coir pith.

7. **Instrumentation and computer applications in agricultural engineering.**—Electronic devices and their characteristics—rectifiers, amplifiers, oscillators, multi vibrators. Digital circuits, Sequential and combinational system. Application of microprocessors in data acquisition and control of agricultural engineering process measurement system for level, flow strain, force, torque, power pressure, vacuum and temperature. Computers—introduction, input/output devices, central processing unit, memory devices, operating systems, processors, key boards and printers. Algorithms, flowchart specification, programme translation and problem analysis in Agricultural Engineering Multimedia and audio-visual aids.

## AGRONOMY

**Principles of Agronomy.**—Definition, history and its relation with other sciences, classification of crops, essentials of crops production, characteristics of good seed, crop growth, yield and factors affecting them, agronomic principles involved in crop production sowing time and methods, crop rotation, multiple cropping, relay cropping, multi-storied cropping, inter-cropping; cropping pattern(s) cropping systems and farming systems, tillage and its objectives, soil tilth and its optimum requirements for important crops, soil fertility, soil productivity and their maintenance, green measuring, manures and fertilizers—their classification, time and methods of application, water and its efficient use in crop production, weed management in crop production.

**Agriculture Meteorology.**—Definition and explanation of basic terms (radiation, albedo, black body, atmosphere, temperature inversion, lapse rate, isobars, cyclones, anticyclones, relative humidity,

absolute humidity, frost, hail, fog, tornado, hurricanes, fronts), micro-climate and macro-climate ; importance of meteorological processes in agriculture, influence of agro-meteorological factors on different plant processes and pests and diseases, climatic requirements of major crops, fruit trees and pests and diseases, crop protection from weather hazards.

*Elementary Crop Physiology.*—Importance of crop physiology in crop production, manipulation of conditions for optimizing germination and growth, yield/economic components of crops, seed dormancy in relation to crop production, role of water and nutrients in various physiological processes and their effect on crop growth, development and yield, leaf area, leaf area index, its role in dry matter accumulation and crop yield, concepts and application of photoperiodism, thermoperiodism and vernalization in crop production, morphological and physiological changes during grain formation and maturity, concept of metabolic sinks, photosynthetic efficiency and physiological maturity.

*Field Crops (Kharif Crops-including forages, cereals, oilseeds and commercial crops).*—Origin, history, distribution, morphology, phasic development, yield attributes, economic importance, soil and climatic requirements varieties, improved agronomic practices, crop rotation, harvesting and quality components of important kharif cereal crops (rice and maize), pulse (Black grams, green gram, horse gram, red gram, bean and cowpea), oilseeds (soyabean, sesamum, sunflower, castor and ground nut), forage crops (napier and teosinte, millets (sorghum, pearl millet, foxtail millet, proso millet, little millet, kodo millet and barnyard, millet) and commercial crops (mesta, sunhemp and cotton).

*Field crops-I (Rabi Crops including forages/cereals/millets and pulses.*—Origin, history, distribution, morphology, phasic development, yield attributes, economic importance, soil and climatic requirements, varieties, improved agronomic practices, crop rotation, harvesting and quality component of important rabi (mcereal crops) (wheat, barley and buckwheat, pulse crops) gram and lentil, (oilseed crops) rapeseed and mustard, linseed, sunflower, etc.), forage crops (berseem, shaftal, Vicia, lucern and clovers) and commercial crops (tobacco, sugarcane, sugarbeet, etc.).

*Rainfed Agriculture.*— Definition, concept and characteristics of rainfed farming and its dimensions in India and Himachal Pradesh, types of drought, mechanism of plant adaptation to water stress, effect of water stress on morphology and physiology of crop plants, water shed—definition and concept of its management, agro-techniques, crops and cropping systems under rainfed agriculture, contingency crop/ planning, soil and moisture conservation practices—terracing, bunding, strip cropping, mulching, etc. macro—and micro-water harvesting techniques.

*Weed Management.*—Weed-definition, classification and characteristics, uses and harmful effects of weeds, dissemination, propagations and dormancy of weeds, association of weeds with various crops, weed management methods—cultural, mechanical, chemical and biological, concepts of integrated weed management, weed management in various crops, toxicity of herbicides, aquatic weeds—classification, important characteristics and control measures, problematic weeds—characteristics, concern to human beings and their management.

*Farming System and Sustainable agriculture.*—Definition and concept of system and systems approach, farming system and sustainable agriculture, farm resource inventory and their management, components of farming system, basic principles of farm management—their application for profit maximization and sustainability, environmental (soil, air, water) degradation—its consequences on agricultural productivity agro techniques for sustainable agricultural-integrated nutrient management, integrated pest management, organic farming, soil conservation, irrigation and drain water management, non-monetary and low cost inputs.

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**ANIMAL HUSBANDRY AND VETERINARY SCIENCE**

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**SECTION-A :****1. Animal Nutrition :**

Energy sources, energy metabolism and requirements for maintenance and production of milk, meat, eggs and work. Evaluation of feed as sources of energy.

1.1 *Advanced studies in Nutrition, Protein.*— Sources of protein, metabolism and synthesis, protein quantity and quality in relation to requirements. Energy—protein ratios in a ration.

1.2 *Advanced studies in Nutrition Minerals.*— Sources, functions, requirements and inter-relationship of the basic mineral nutrients including trace elements.

1.3 *Vitamins, Hormones and Growth Stimulating substances.*— Sources, functions, requirements and inter-relationship with minerals.

1.4 *Advanced Ruminant Nutrition Dairy Cattle.*—Nutrients and their metabolism with reference to milk production and its composition. Nutrient requirements for calves, heifers, dry and milking cows and buffaloes. Limitations of various feed systems.

1.5 *Advanced Non-Ruminant Nutrition Poultry.*— Nutrients and their metabolism with reference to poultry, meat and egg production. Nutrient requirements and feed formulation for broilers at different ages.

1.6 *Advanced Non-Ruminant Nutrition Swine.*—Nutrients and their metabolism with special reference to growth and quality of meat production. Nutrient requirements and feed formulation for baby, growing and finishing pigs.

1.7 *Advanced Applied Animal Nutrition.*— A critical review and evaluation of feed experiments, digestibility and balance studies. Feeding standards and measure of feed energy. Nutrient requirements for growth, maintenance and production. Balanced rations.

**2. Animal Physiology :**

2.1 *Growth and Animal Production.*—Pre-natal and post-natal growth, restoration growth curves, measures of growth, factors affecting growth, conformation, body composition, meat quality.

2.2 *Milk production and reproduction and Digestion.*—Current status of hormonal control of mammary development, milk secretion and milk ejection. Composition of milk of cows and Buffaloes. Male and female reproduction organs, their components and functions. Digestive organs and their functions.

2.3 *Environmental Physiology.*—Physiological relations and their regulation mechanisms of adoption, environmental factors and regulatory mechanism involved in animal behavior, methods of controlling climatic stress.

2.4 *Semen quality.—Preservation and Artificial Insemination.*— Components of semen., Composition of spermatozoa, chemical and physical properties of ejaculated semen, factors affecting semen *in vivo* and *in vitro*. Factors affecting semen preservation, composition of dilutents, sperm concentration, transport of diluted semen, deep freezing techniques in cows, sheeps and goats, swine and poultry.



### 3. **Livestock production and management :**

3.1 *Commercial Dairy Farming.*—Comparison of dairy farming in India with advanced countries. Dairying under mixed farming and as a specialized farming, economic dairy farming. Starting of a dairy farm, capital and land requirement, organization of the dairy farm, procurement of goods. Opportunities in dairy farming. Factors determining the efficiency of dairy animals. Herd recording, budgeting, cost of milk production, pricing policy, personnel management.

3.2 *Feeding practices of dairy cattle.*—Developing practical and economic rations for dairy cattle, supply of greens throughout the year, fields and fodders requirements of dairy farm, feeding regimes for day per young stock and bulls, heifers and breedings animals, new trends in feeding young and adult stock, feeding records.

3.3 General problems of sheep, goat, pigs and poultry management.

3.4 Feeding of animals under drought conditions.

### 4. **Milk Technology :**

4.1 Organisation of rural Milk procurement, collection and transport of raw milk.

4.2 Quality, testing and grading raw milk, quality, satorage grades of whole milk, skimmed milk and cream.

4.3 Processing, packaging, storing, distributing, marketing, defects and their control and nutritive properties of the following milks. Pasteurised, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined, filled and flavoured milks.

4.4 *Milk Product Technology.*—Selection of raw materials, assembling production, processing, storing, distributing and marketing milk products such as Butter Ghee, Khoa, Chhaina, Cheese, condensed evaporated dried milk and baby foods, ice cream and kilfi, bye-oproducts, whey products, butter milk, lactose and casein, testing, grading, judging milk products and agents specifications (ISI and Agmark) Legal standards, quality control, nutritive properties, packaging, processing and operational control costs.

4.5 Preparation of cultured milks, cultures and their management. Vitamin-D, soft and other special milks.

4.6 Legal standards, sanitation requirement for clean and safe milk and for the Milk Plant equipment.

### SECTION-B :

*Genetics and Animal Breeding.*—Probability applied to Mendelian inheritance. Hardy-Weinberg Law. Concept and measurement of inbreeding and heretrozygosity—Wright's approach in contrast to Male cost's Estimation of Parameters and Measurements. Fisher's theorem of natural selection, polymorphism, polygenic systems and inheritance of quantitative traits. Casual components of variation. Biometrical models and covariance between relatives. The theory of pathoeq efficient applied to quantitative genetic analysis. Heritability, repeatability and selection models.

1.1 *Population Genetics applied to Animal Breeding.* — Population V.S. individual, population size and factors changing it. Gene number and their estimation in farm animals, gene frequency and zygotic frequency and forces changing them, mean and variance approach to equilibrium under different situations. Sub-Division of phenotypic variance, estimation of additive, non-additive genetic and environmental variances in Animal population, Mendelism and blending inheritance. Genetic nature of differences between species, races, breeds and other sub-specific grouping and the grouping and the origin of group differences. Resemblance between relatives.

1.2 *Breeding systems.* — Heritability, repeatability, genetics and environmental correlation, methods of estimation and the precision of estimates of animal data. Review of biometrical relations between relatives, mating system's inbreeding, out-breeding and uses. Phenotypic assortative mating. Aids to selections. Family structures of animal population under non-random-mating systems. Breeding for threshold traits, selection index, its precision, general and specific and combining ability, choice of effective breeding plants.

Different types and methods of selection, their effectiveness and limitations, selection indices, construction of selection in retrospect, evaluation of genetic gains through selection, correlated response in animal experimentation's.

Approach to estimation of general and specific combining ability, diallele, fractional diallele crosses reciprocal recurrent selection, inbreeding and hybridization.

## 2. Health and Hygiene

Anatomy of Ox and Fowl Histological technique, freezing, paraffin embedding etc. Preparation and staining of blood films.

2.1 Common histological stains, embryology of a cow.

2.2 Physiology of blood and its circulation, respiration, excretion, endocrine glands in health and disease.

2.3 General knowledge of pharmacology and therapeutics of drugs.

2.4 Vet-hygiene with respect of water, air and habitation.

2.5 Most common cattle and poultry diseases, their mode of infection, prevention and treatment etc. Immunity, General principles and problems of meat inspection, jurisprudence of vets practice.

2.6 Milk Hygiene.

## 3. Meat Hygiene:

3.1 *Zoonosis.*—Diseases transmitted from animals to man.

3.2 Duties and role of Veterinarians in a slaughter house to provide their meat that is provided under ideal hygienic conditions.

3.3 Bye-products from slaughter houses and their economic utilization.

3.4 Methods of collection, preservation and processing of hormonal glands for medicinal use.

4. Extension

- 4.1 Extension, different methods adopted to educate farmers under rural conditions
- 4.2 Utilization of fallen animals for profit extension education etc.
- 4.3 *Define Trysem.*—Different possibilities and methods to provide self-employment to educated youth under rural conditions.
- 4.4 Crossbreeding as a method of upgrading and local cattle.

**BOTANY**

SECTION-A:

(Microbiology, Pathology, Plant Groups and their Morphology, Anatomy, Taxonomy, Embryology of Angiosperms)

1. *Microbiology.*—(Viruses and Bacteria). Their structure, classification, reproduction and physiology, Mode of infection of Viruses and Bacteria Role of microbes in industry and agriculture.
2. *Pathology.*— Knowledge of common and important plant diseases caused by fungi and bacteria (Special reference to diseases common in Himachal Pradesh), mode of infection of fungi and control of disease.
3. *Plant Groups.*—Classification, structure, reproduction, life history and economic importance of Algae, Fungi, Bryophytes Pteridophytes and Gymnosperms (including comparative study of various groups). A general knowledge of distribution of important genera of principal sub-division of above groups in India (Emphasis of Western Himalayas).
4. *Morphology, Anatomy, Embryology and Taxonomy of Angiosperms.*—Morphology and Anatomy of Stem, Root, Leaf (excluding anomalous growth Tissue and Tissue system). Structure of Anther and Ovule. Fertilization and development of seed. Classification of Angiosperms, Principles of Nomenclature. Modern trends in Taxonomy. A general knowledge of following families of Angiosperms.

Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Rosaceae, Leguminosae, Cucurbitaceae, Umbelliferae, Asteraceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Gramineae.

SECTION-B:

(CELL BIOLOGY, GENETICS AND EVOLUTION, PHYSIOLOGY, ECOLOGY AND ECONOMIC BOTANY)

1. *Cell Biology.*—Cell as a unit of structure and function. Ultrastructure of Cell and its various organelles. Chromosomes- the physical and chemical structure, its behavior during mitosis and meiosis.
2. *Genetics and Evolution.*—Pre and Post Mendelian concept of Genetics. Development of Gene concept. Genetic code Nucleic acids, their structure and role in reproduction and protein bio-synthesis, Mutations. Role of mutations in plant breeding (wheat, gram, tobacco, cotton only), Organic evolution-evidences and theories.

3. *Physiology*.—Photosynthesis, Absorption and conduction of water, Transpiration, Mineral absorption, Role of elements, Enzymes, Respiration, Fermentation, Growth, Photoperiodism and Vernalisation, Plant Hormones—their type and role Dormancy of seeds.

4. *Plant Ecology*.—Its scope, plant communities, plant succession, factors. Applied ecology with special reference to pollution and conservation.

5. *Economic Botany*.—Importance of plants, important plants yielding food, fibre, wood and drugs.

## CHEMISTRY

(Note:—The student will be expected to solve simple structural, synthetic, mechanistic, conceptual and numerical problems based on and relevant to the syllabus. They are also expected to be acquainted with the S L units).

### SECTION-A :

*Atomic Structure and Chemical bonding*.— Quantum theory, Schrodinger equation, particle in a box, hydrogen atom, hydrogen , molecule. Elements of valence bond and molecular orbital theories (idea of bonding, non-bonding and anti-bonding orbitals). Sigma and Pi bonds.

*Chemical Kinetics*.—Kinetics of reactions involving free radicals, Kinetics of polymerisation and photochemical, reactions.

*Surface chemistry and. catalysis*.— Physical absorption, 'isotherms, surface area determination, heterogenous catalysis, acid bases and enzyme catalysis.

*Electrochemistry*.— Lomc equilibra, theory of strong electrolytes, Debye, Huckel theory of activity Co-efficient electrolytic conduction, galvanic cell, membrane equilibrium and fuel cells. Electrolysis and over voltage.

*Thermodynamics*.—Laws of Thermodynamics and application to physiochemical processes systems of variable compositions.

*Electronic structure of transition metal complexes*.—Crystal field theory and modifications, complexes of Pi-acceptor legends, organometallic compounds of transition metals.

*Lanthanides Actinides*.—Separation Chemistry, Oxidation state, magnetic properties.

Reaction in non-aqueous solvents.

### SECTION-B :

## PHYSICAL ORGANIC CHEMISTRY

*Electronic displacements*.— Inductive, electromeric, mesomeric and hyper-conjugative effects. Electrophiles, nucleophiles and free radicals. Resonance and its application to organic compounds. Effect of structure on the dissociation constants of organic acids and basis. Hydrogen bond and its effects on the properties of organic compounds.

Modern concepts of organic reaction mechanisms, addition, substitution, elimination and rearrangement. Reaction involving free radicals. Mechanisms of aromatic substitution: Benzene intermediates.

*Aliphatic Chemistry.*—Chemistry of simple organic compounds belonging to the following classes—alkanes, alkynes, alkyl halides, alcohol, thiols, aldehydes, ketones, acids and their derivatives, ethers, amines, Amino acids, hydroxy acids, unsaturated acids, dibasic acids.

*Synthetic uses of the following.*—Acetoacetic and malonic esters, organometallic compounds of magnesium and lithium, ketene, carbene and diazomethane.

*Carbohydrates.*— Classification, and general reactions of simple monosaccharide, chemistry of glucose, fructose and sucrose.

*Stereo Chemistry.*—Elements of symmetry and simple symmetry operation. Optical and geometrical isomerism in simple organic molecules, E.Z and R.S notations. Conformations of simple organic molecules. Stereochemistry of inorganic co-ordination compounds.

*Atomic Chemistry.*—Benzene, toluene and their halogeno, hydroxy, nitro and amino derivatives, Sulphuric acid, Zylere, Benzaldehyde, Salicylic aldehyde, acetophenone, Benzoic, phthalic, salicylic, cinnamic and mandelic acids. Reduction products of nitrobenzene, Diazonium salts and their synthetic uses.

Structure, synthesis and important reaction of naphthalenes anthracene, Phenanthrene, Pyridine and quinoline.

*Basic concepts regarding the following materials of economic and medical importance.*—Cellulose and starch, coal tar, chemicals, organic polymers. Oils and fats, petrochemicals, vitamins, hormones, alkaloids (fermentation products including antibiotics, proteins).

*Organic Photochemistry.*—Energy level diagrams, quantum yield, Photochemistry of simple organic molecules.

*Polymers.*—Physical chemistry of Polymers. Molecular weight averages and group analysis, sedimentation light scattering and viscosity of Polymer solutions.

Alloys and inter-metallic compounds.

## CHEMICAL ENGINEERING

### SECTION-A :

(a) *Fluid and Particle Dynamics.*—Viscosity of fluids. Laminar and turbulent flows. Equation of continuity and Navier-Stokes equation, Bernoulli's theorem, Flow meters, Fluid drag and pressure drop due to friction. Reynold's Number and friction factor—Effect of pipe roughness, Economic pipe diameter, Pumps, water airstream jet ejectors, compressors, blowers and fans. Agitation and mixing of liquids, Mixing of solid and pastes. Crushing and grinding—principles and equipment. Rittinger's and Bond's laws, Filtration and filtration equipment. Fluid —particle mechanics—free and hindered settling. Fluidization and minimum fluidization velocity, concept of compressible and incompressible flow. Transport of solids.

(b) *Mass Transfer*.—Molecular diffusion co-efficients first and second law and diffusion, mass transfer co-efficients, film and penetration theories of mass transfer. Distillation, simple distillation, relative volatility, fractional distillation, plate and packed columns for distillation. Calculation of the oratical numbers of plates. Liquid-liquid equilibria, Extraction theory and practice, Design of gas absorption columns, Drying, humidification, de-humidification, Crystallisation, Design of equipment.

(c) *Heat Transfer*.—Conduction, thermal conductivity, extended surface heat transfer. Convection—free and forced. Heat transfer co-efficient —Nusselt number. LMTD and effectiveness. NTU methods for the design of Double Pipe and Shell & Tube Heater Exchangers, Analogy between heat and msneritum transfer, Boiling and condensation heat transfer, single and multiple-effect evaporaters, Radiation, Stefan-Boltzman Law, emissivity and absorptivity. Calculation of heat load of a furnace. Solar heaters.

(d) *Noval Separation Processes*.—Equilibrum separation processes ion-exchange, osmosis, electro-dialysis, reverse osmosis, ultra-filtration and other membrane processes. Molecular distillation, super critical fluid extraction.

(e) *Process Equipment Design*.—Factors affecting vessel design criteria—Cost consideration, Design of storage vessels—vertical, horizontal, spherical, underground tanks for atmospheric and higher pressure. Design of closures flat and elliptical head, Design of support, Materials of construction characteristics and selection.

(f) *Process Dynamic and control*.—Measuring instruments for process variables like level, pressure flow, temperature PH and concentration with indication in visual/ pneumatic/analogy/digital signal forms, Control variable, manipulative variable & load variables. Linear control theory —Laplace, transforms, PI D controllers, Unlock diagram representation transient and frequency response, stability of closed loop system Advanced control strategies, Computer bases process control.

## SECTION-B:

(a) *Material and Energy Balance*.—Material and energy balance calculations in process within cycle/ bypass/ purge. Combustion of solidi /liquid gaseous fuels, stoichiolnetric relationships and excess air requirements. Adaibatic flame temperature.

(b) *Chemical Engineering Thermodynamics*.—Laws of thermodylamics, PVT relationships for components and mixtures. Energy functions and inter-relationships—maxwell's relations. Fugacity, activity and Chemical potential. Vapour-liquid equilibria for ideal/ non-ideal, single and multicomponent systems, Criteria for chemical reaction equilibrium, equilibrium constant and equilibrium conversions, Thermodynamic cycles—refrigeration and power.

(c) *Chemical Reaction Engineering*.—Batch reactors —ki netics and homogeneous reactions and interpretation of kinetic data, Ideal now reactors —CSTR, plug flow reactors and their performance equations. Temperature effects run-away reactions, Heterogeneous reactions —of lytic and non-catahric & gas-solid & gas -liquid reactions. Intrinies kinetics and global rate concept. Importance of lyticse & interparticle mass transfer on pure performance. Effectiveness factors, Isothermal and non-isothermal reactors and reactor stability.

(d) *Chemical Technology*.—Natural organic products —Would and wood-based chemicals, pulp and paper, Agro-industries-sugar, Feasible oils extraction (including tree based seeds), Soaps and deterqents, Essential oils —Biomass glassification (including biogas), Coal and coal chemical/Petroleum and Natural

gas—petroleum refining (Atmospheric distillation/ cracking/reforming)—Petrochemical industries—Polythylenes (LDPE/HIOP/LLDPE), Polyvinyl Chloride, Polystyrene, Ammonia manufacture, Cement and lime industries, Paints and Varmishes, Glass and ceramics. Fermentation—alcohol and antibiotics.

(e) *Environmental Engineering and Safety*.— Ecology and Environment Sources of pollutants in air and water. Green house effect, ozone layer depletion, acid, rain, micrometeorology and dispersion of pollutants in environment, Measurement technique of pollutant levels and their control strategies, Solid waste, their hazards and their disposal techniques, Design and performance analysis of pollution control equipment, Fire and explosion hazards rating-HAZOP and HAZAN, Emergency planning disaster, Management Environmental legislation's-water air environment protection Acts, Forest (Conservation) Act.

(f) *Process Engineering Economics*.— Fixed and working capital requirement for process industry and estimation methods, Cost estimation and comparison or alternatives, Net present value by discounted cash flow. Pay back analysis, IRR, depreciation, taxes and insurance, Break-even point analysis. Project scheduling —PERT and CPM— Profit and loss account, balance sheet and financial statement, Plant location and plant layout including piping.

## CIVIL ENGINEERING

### SECTION-A :

#### (A) THEORY AND DESIGN OF STRUCTURES:

(a) *Theory*.—Principale of superposition, reciprocal theorem, unsymmetrical bending.

Determinate and indeterminate structures, simple and space frames, degrees of freedom, virtual work, energy theorems, deflection of trusses, redundant frames, three moment equation, slope deflection and moment distribution methods. Column analogy, energy methods approximate and numerical methods.

*Moving loads*.—Shearing force and bending moment diagrams, influence lines for simple and continuous beams and frames.

Analysis of determinate and indeterminate arches, spandrel braced arch.

Matrix methods of analysis, stiffness and flexibility matrix. Elements of plastic analysis.

(b) *Steel Design*.—Factors of safety and load factor, design of tension, compression and flexural members built up beams and plate girders, semi-rigid and rigid connections.

Design of stanchions, slab and gusseted bases, crane and gantry girders, roof trusses, industrial and multi-storeyed building, water tanks.

Plastic design of continuous frames and portals.

(c) *R.C. Design*.—Design of slabs, simple and continuous beams, columns, footings single and combined, raft foundations, elevated water tanks, encased beams and columns, ultimate load design.

Methods and system of pre-stressing, anchorages, losses in pre-stress design of pre-stressed girders, ultimate load design.

**(B) FLUID MECHANICS AND HYDRAULIC ENGINEERING:**

Dynamics or fluid equations of continuity, energy and momentum, Bernoulli's theorem, cavitation, Velocity potential and stream function, rotational and irrotational flow, free and forced vortices, flow net.

Dimensional analysis and its application to practical problems.

*Viscous Flow.*—Flow between static and moving parallel plates, flow through annular tubes, film lubrication, velocity distribution in laminar and turbulent flow boundary layer.

*Incompressible flow through pipes.*—Laminar and turbulent flow, critical velocity, losses, momentum diagram. Hydraulic and energy grade lines, siphons pipe joint forces on pipe bends.

*Compressible flow.*—Adiabatic and isentropic now subsonic and supersonic velocity, Mach number, shock waves, water hammer.

*Open channel flow.*—Uniform and non-uniform flow, best hydraulic cross-section, Specific energy and critical depth gradually varied flow classification of surface profiles, Control sections, Standing wave flumes Surges and waves, hydraulic jump.

*Design of canals.*—Unlined channel in alluvium, the critical tractive stress, principles of sediment transport regime theories, lined channels, hydraulic design and cost analysis, drainage behind lining.

*Canal structures.*—Designs of regulation work, cross drainage and communication work—cross regulators, head regulator, canal falls, aqueducts, metering flumes etc. canal outlets.

*Diversion head works.*—Principles of design of different parts on impermeable and permeable foundations, Khosla's theory, energy Sediment analysis.

*Dams.*—Design of rigid dams, earth dams, forces acting on dams, stability analysis.

Design of Spillways, Wells and Tube Wells.

**(C) SOIL MECHANICS AND FOUNDATION ENGINEERING:**

*Soil Mechanics.*—Original classification of soil, atterburg limits, void ratio, moisture Contents, permeability, laboratory and field tests, Seepage and flow nets, flow under hydraulic structures, uplift and quick sand condition. Unconfined and direct shear tests, triaxial test, earth pressure theories, stability of slopes, theories of soil consolidation, rate of settlement, Total and effective stress analysis, pressure distribution in soils, Boussinesque and Westergaard theories. Soil Stabilization.

Foundation Engineering.—Bearing capacity of footings, piles and wells, design of retaining walls, sheet piles and caissons.

**SECTION-B:****(D) BUILDING CONSTRUCTIONS:**

*Building materials and constructions.*—Timber, stones, brick, sand, surkhi, mortar, concrete, paints and varnishes, plastic, etc.



Detailing of walls, roofs, floors, ceilings, staircases, doors and windows. Finishing of buildings—plastering, pointing, painting etc. Use of building codes, ventilation, air conditioning, lighting and acoustics.

Building estimates and specifications, construction scheduling, PERT and CPM methods.

#### (E) RAILWAYS AND HIGHWAYS ENGINEERING:

(a) *Railways*.—Permanent (way, ballast, sleeper, chairs and fastenings, points and crossing, different types of turn outs, cross-overs, setting out of points.

Maintenance of track, super elevation, creep of rail, ruling gradients, track resistance, tractive effort, curve resistance.

Station yards and machinery, station buildings platform sidings, turn tables.

Signal and inter locking, level crossings.

(b) *Roads and Runways*.—Classification of roads, planning, geometric design of flexible and rigid pavements, sub-bases and wearing surfaces, Traffic engineering and traffic surveys, intersections road signs, signals and markings.

#### (F) WATER RESOURCES ENGINEERING:

*Water requirements for crop*.—Quality of irrigation water, consumptive use of water, water depth and frequency of irrigation duty of water, irrigation methods and efficiencies.

*Distribution system for canal irrigation*.—Determination of required channel capacity channel losses, alignment of main and distributory channels.

*Storage Works*.—Types of dams (including earth dams) and their characteristics, principles of design, criteria for stability, Foundation treatment, joints and galleries, Control of seepage.

*Spillways*.—Different type and their suitability, energy dissipation, spillway crestgates.

#### (G) SANITATION AND WATER SUPPLY:

*Sanitation*.—Site and orientation of buildings, ventilation and damp proof course, house drainage, conservancy and water borne system of waste disposal Sanitary appliances—latrines and urinals.

Disposal of sanitary sewage, industrial waste, storm sewage—separate and combined system, flow through sewers, design of sewerage and sewer appurtenances, manholes, inlets, junctions, siphon, ejection etc. Sewer treatment working principles, units, chambers, sedimentation tank etc. Activated sludge processes, septic tank, disposal of sludge, Rural sanitation, environment pollution and ecology.

*Water Supply*.—Estimation of water resources. ground water hydraulics, predicting demand of water, Impurities of water—physical, chemical and bacteriological analysis. Water borne diseases.

*Intake of water*.—Pumping and gravity schemes, Water treatment, Principles of settling, coagulation, flocculation and sedimentation, Slow, rapid and pressure filters, silencing ing, removal of taste, odour and salinity.

*Water distribution.*— Layout storage, hydraulic pipelines, pipe fittings, pumping stations and their operation.

## ECONOMICS

### SECTION-A:

1. Economic choice, consumer behavior, producer behavior and market forces.
2. Investment decisions and determination of income and employment. Macro- economic model of income, distribution and growth.
3. Banking, objectives and instruments of Central Banking Credit Policies in a planned developing economy.
4. Types of taxes and their impacts on the economy. The impacts of the size and the content of Budgets. Objectives and instruments of budgetary and fiscal policy in a planned developing economy.
5. International trade, Tariffs, The rate of exchange, The balance of payments, International monetary and banking instructions.

### SECTION-B:

1. The Indian Economy.
2. Guiding principles of Indian economic policy —planned growth and distributive justice— eradication of poverty.  
The institutional frame work of the Indian economy—federal government structure—agricultural and industrial sectors — Public and Private Sectors.
3. National income—its sectoral and regional distribution—extent and incidence of poverty.
4. Agricultural production, agricultural policy.  
Land reforms, technological change, Relationship with the industrial sector.
5. Industrial production—Industrial policy.  
Public and Private Sectors.  
Regional distribution, Control of monopolies and monopolistic practices.
6. Pricing policies for agricultural and industrial out-puts. Procurement and public distribution.
7. Budgetary trends and fiscal policy.
8. Monetary and credit trends and policy—banking and other financial institutions.
9. Foreign trade and balance of payments
10. Indian Planning—objectives, strategy, experience and problems.

## FORESTRY-I

### SECTION-A

#### 1. Silviculture :

1.1 *General Silviculture Principles.*—Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests, methods of propagation of forests, methods of propagation, grafting techniques, site factors, nursery and planting techniques—nursery beds, polybags and maintenance, water budgeting, grading and hardening of seedlings, special approaches, establishment and tending.

1.2 *Silvicultural Systems.*—Clear felling, uniform shelter wood selection, coppice and conversion systems, Management of silviculture systems of temperate, subtropical, humid tropical, dry tropical and coastal tropical forests with special reference to plantation silviculture, choice of species, establishment and management of standards, enrichment methods, technical constraints, intensive mechanized methods, aerial seeding techniques.

1.3 *Silviculture of Mangrove and Cold Desert*.— Mangrove habitat and characteristics, mangrove, plantation-establishment and rehabilitation of degraded mangrove formations, silvicultural systems for mangrove, protection of habitats against natural disasters, Cold desert—Characteristics, identification and management of species.

1.4 *Silviculture of trees*.— Tradition and recent advances in tropical silvicultural research and practices, Silviculture of some of the economically important species in India such as *Acacia catechu*, *Acacia nilotica*, *Acacia auriculiformis*, *Albizia lebbeck*, *Albizia procera*, *Anthocephalus Cadamba*, *Anogeissus latifolia*, *Azadirachta indica*, *Bamboo spp.*, *Butea monosperma*, *Cassia siamea*, *Casuarina equisetifolia*, *Cedrus deodara*, *Chukrasia tabularis*, *Dalbergia sisoo*, *Depterocarpus spp.*, *Emblica officindils*, *Eucalyptus spp.*, *Gnelina Aboreiaca*, *Hardwickia binata*, *Lagerstoremia Lanceolata*, *Pinus roxburghi*, *Populus spp.*, *Pterocarpus marsupium*, *Prosopis juliflora*, *Santalum album*, *Semecarpus anacardium*, *Shorea robusta*, *Salmalia malabaricum*, *Tectona grandis*, *Terminalis sememntosa*, *Tamarindus indica*.

## 2. Forest Ecology and Ethnobotany :

Biotic and abiotic components, forest eco-systems, forest community concepts, vegetation concepts, ecological succession and climax, primary productivity, nutrient cycling and water relation, physiology in stress environments (drought, water logging salinity and alkalinity). Forest types in India, identification of species, composition and associations, dendrology, taxonomic classification, principles and establishment of herbaria and arboreta, Conservation of forest ecosystems, Clonal parks.

Role of Ethnobotany in Indian Systems of Medicine, Ayurveda and Unani-Introduction, nomenclature, habitat, distribution and botanical features of medicinal and aromatic plants. Factors affecting action and toxicity of drug plants and their chemical constituents.

## 3. Environmental Conservation and Bio diversity:

3.1 *Environment*.—Components and importance, principles of conservation, impact of deforestation, forest fires and various human activities like mining, construction and developmental projects, population growth on environment.

3.2 *Bio-diversity*.— Concepts and principles, importance of bio-diversity conservation, in-situ and ex-situ methods of conservation, measurement of diversity, diversity indices, Biosphere concept, hotspots of bio-diversity, Indian bio-diversity and gene pool, conservation efforts in India and world-wide, bio-diversity conventions and treaties.

3.3 *Pollution*.— Types, global warming green house effects, ozone layer depletion, acid, rain, impact and control measures, environmental monitoring, concept of sustainable development, Role of trees and forests in environmental conservation, control and prevention of air, water and noise pollution. Environmental Impact Assessment, Economics assessment or watershed development *vis-à-vis* ecological and environmental protection.

## 4. Tree Improvement, Seed Technology and Biotechnology:

4.1 General concept of tree improvement, methods and techniques, variation and its use provenance, seed source, exotics, quantitative aspects of forest tree improvement, seed, production and seed orchards, progeny tests, use of tree improvement in natural forest and stand improvement, genetic testing programming, selection and breeding for resistance to diseases, insects, and adverse environment;

the genetic base, forest genetic resources and gene conservation in situ and ex-situ. Cost benefit ratio, economic evaluation.

**4.2 Biotechnology:**— Historical developments, scope of biotechnology in agriculture, forestry and industry. Plant tissue culture, response patterns, Application of plant tissue culture in plant improvement. In vitro selection, micro propagation of forest trees and medicinal plants, germ plasm conservation and enrichment, recent developments, Gene regulation, genetic engineering techniques, transgenic plants and animals, case studies with special reference to genetic modification of tree species to diseases, pest and other forms of stress. Modification of plant species to practice desired products, Biodegradation of agriculture and forestry wastes through genetically engineered microbes.

**5. Forest Pathology:**— Importance and brief history of Forest pathology, terminology; concept, causes and classification of plant diseases; symptomatology; stages in disease development; dissemination of pathogens; inoculum and inoculum potential; pathogenesis- role of toxins and enzymes; variability in pathogens; disease resistance; plant disease epidemics; disease forecasting; management of diseases through regulatory, cultural, physical, chemical and biological methods; integrated disease management; biotechnology in plant pathology. Common forest, fungi, diseases and methods of control. Nursery diseases of important forest species. Diseases of important tree species.

Principles of forest disease management. Definition and scope of disease management in forestry importance or disease cycle and economic threshold in disease management. Principles of disease management such as exclusion, cultural, chemical, biological and immunization. Nature of disease resistance. Fungicides and their use in nurseries and plantations. Integration of cultural, chemical, biological and host resistance in effective disease management, Meristematic and tissue culture techniques in disease management.

Biodegradation of wood in use. Types of wood decay, gross characters of decay, sap stain, different types of rots in hardwoods, woods and their prevention. Graveyard test and decay resistant wood.

**6. Forest Entomology:**— Definition importance and scope of Entomology. Definition of insect and its position in the Animal Kingdom. Important characters of phylum arthropoda and class insect. External morphology of generalized insect. Insect growth and development, Reproduction in insects, mature states (Egg, Larvae/nymph and pupae); metamorphosis in insects.

Taxonomic classification of class insects, diagnostic characters of the orders and major families of economic importance.

History and importance of Forest Entomology in India. Methods and principles of pest control: Mechanical, physical, silvicultural, legal, biological and chemical. Principles and techniques of integrated pest management in forests.

Classification of forest pests: Types of damages and symptoms; factors for out break of pests. Nature of damage and management. Insect pests of forest seeds, forest nursery and standing trees of timber yielding species of natural forest (Tectona, Dalbergia sp. Sal, Albizia spp. Sandal, Ailanthus, Gmelina, Terminalia, Deodar, Pines). Plantation forest species (Eucalyptus, Bamboo, Casuarina, Neem, Acacia). Fruit trees (Emblica, Ber, Eugenia, Tamarind). Insect pests of freshly, felled trees, finished timbers and their management.

Morphology of plant parasitic nematodes, brief classification of important genera of nematodes. Important diseases caused by different genera and their management practices.

7. *Wildlife Management and Conservation.* History of wildlife management and conservation in India; cultural background. Habitat management: purposes, principles, practices and tools-fire, cutting, grazing, habitat interspersation and edge effect. Provision of water, saltlicks and food. Zoning core, buffer, tourism and multiple use in protected areas.

*Wildlife damage control.* Mitigating human wildlife conflict-fences, trenches, walls, lure crops, repellents, translocation and compensation.

*Captive Wildlife.* Zoos and safari parks. Captive breeding for conservation. Role of Central Zoo Authority of India.

*Wildlife census.* Purpose, techniques. Direct and indirect methods of population, estimation. Sample and total counts, indices, encounter rates and densities.

Wildlife (Protection) Act, 1972. Protected areas- Sanctuary National Park and Biosphere Reserves. Special projects for Wildlife conservation. Project Tiger and Musk Deer Project. Introduction and reintroduction of species. Wildlife corridors. MAB, Red Data Book, Category threat, CITES. Conservation Meaning, principles and strategies, ill-situ and ex-situ conservation, conserving bio-diversity. Politics-socio-economic, role of education and extension.

## SECTION-B:

### 8. FOREST MANAGEMENT

8.1 *Forest Management and Management Systems.* Objective and principles; techniques; forest management systems-their evolution and application, world forestry systems, Forest resources and forestry practices in different regions of the world International forestry organizations; stand structure and dynamics, sustained yield relation; rotation, normal forest, growing stock; regulation of yield; management of forest plantations, commercial forests, forest cover monitoring. Approaches viz., (i) site-specific planning (ii) strategic planning, (iii) Approval, sanction and expenditure, (iv) Monitoring (v) Reporting and governance. Range land management need and importance, distribution, characteristics, status and management of range lands, ecology of range lands and impact of grazing, range land inventory methods, range equipment techniques, alpine pastures, their importance in nomadic grazing and growth of medicinal shrubs & herbs.

8.2 *Forest Working Plans.*— Forest Planning, evaluation and monitoring tools and approaches for integrated planning; multipurpose development of forest resources and forest industries development; working plans, and working schemes, their role in nature conservation, bio-diversity and other dimensions; preparation and control Divisional Working Plans, Annual Plan of Operations.

8.3 *Forest Mensuration, Inventory and Statistics.*— Methods of measuring- diameter girth height and volume of trees; form factor; volume estimation of stand, current annual increment; mean annual increment. Sampling methods and sample plots. Yield calculation; yield and stand tables. Forest inventory- definition, object, kinds of enumeration. Sampling- advantages, kinds of sampling, random sampling simple, stratified, multiphase sampling, non-random sampling: selective, systematic and sequential sampling. Sampling design, size and shapes of sampling units. Point sampling: horizontal and vertical point sampling, forest cover monitoring through remote sensing. Geographic Information Systems for management and modelling. Forest statistics Definition and scope, collection of data and their presentation measures of central tendency, laws of probability, linear correlation and its measure, tests of significance, sampling methods and designs, principles of experimental designs, analysis of variance.

8.4 *Surveying and Forest Engineering.*— Forest surveying- different methods of surveying, maps and map reading. Basic principles of forest engineering. Building materials and construction. Roads and Bridges; General principles; objects, types, simple design and construction of timber bridges.

9. *Forest Protection.*— Injuries to forest, abiotic and biotic factors, destructive agencies, insect-pests and disease, effects of air pollution on forests and forest die back. Susceptibility of forests to damage, nature of damage, cause, prevention, protective measures and benefits due to chemical and biological control. General forest protection against fire, equipment and methods, controlled use 'of fire, economic and environmental costs; timber salvage operations after natural disasters. Role of afforestation and forest regeneration in absorption of CO<sub>2</sub>. Rotational and controlled grazing, different methods of control against grazing and browsing animals; effect of wild animals on forest regeneration, human impacts; encroachment, poaching, grazing, live fencing, theft, shifting cultivation and control.

10. *Watershed Management and Hydrology.*— concepts. or watershed; role of mini -forests and forest trees in overall resource management, forest hydrology, watershed development in respect of torrent control, river channel stabilization, avalanche and landslide controls, rehabilitation of degraded areas; hilly and mountain areas; watershed management and environmental functions of forests; water-harvesting and conservation; ground water recharge and watershed management; role of integrating forest trees, horticulture crops, field crops, ghraiss and fodders. Hydrology, water resources and Engineering - Hydrological cycle, precipitation, evaporation, transpiration, depression storage, infiltration, overland flow, hydrograph, flood frequency analysis, flood estimation, flood routing through a reservoir, water logging-its causes and control. design of drainage system, soil salinity, river training- principles and methods.

11. *Wood Science and Technology.*— Wood as raw material, kinds of woods- hardwood, softwood, bamboos and palms. wood as raw material. The physical features of wood. Mechanical properties of wood, Suitability of wood for various end-uses based on mechanical and physical properties. Electrical and acoustic properties of wood.

Wood water relationship-shrinkage, swelling, "movement, fibre saturating, and equilibrium moisture content. Wood seasoning- merits, principles and types- air seasoning, kiln seasoning, chemical seasoning. Rfractory classes of timbers kiln schedules. Seasoning defect and their control. Wood preservation-principles, processes; need. Types of wood preservatives (Water-soluble, oil based etc.), classification of timbers based on durability. General idea about fire retardant and their usage.

Non-pressure methods- steeping, dipping; soaking open tank process. Boucherie process. Pressure methods- full cell process, empty cell process (Luty and Ruping). Wood machining.

*Sawing-techniques*, kinds of saws-cross cut saw, edging saws, cudless saws, handsaws, and circular saws, quarter sawing bow saws. Wood working, tools used in wood working (parting tools, slicing tools, shaping tools, measuring and marking tools Various stages of woodworking. Dimensional stabilisation of wood by surface coating method, bulking method, impregnation of resins and polymers.

12. *Computer application in Forestry.*— Introduction to computers- Hardware, Software, Firmware, Components of a computer system- Central Processing Unit, Input/output devices Operating system- Batch processing, Multi-user. Personal computer operation, Computer languages-Machine language, assembly language, high level languages. Compilers and interpreters.

Problem solving on a computer, simple algorithms, flowchart marking, BASIC language, constants and variable, Operations- arithmetic, relational and logical operations.

Writing simple programmes "in BASIC language to compute the Mean, variance, Correlation Regresson word processing and spreadsheets, preparation of forest databases.

13. *Remote Sensing and GIS in Forestry*.— Principle, forest cover mapping through remote sensing, use of remote sensing in forest inventories, GIS fundamentals, GIS in modelling and management of forest resources.

## FORESTRY-II

### SECTION-A:

#### I. Social, Agro and Farm Forestry:

1.1 *Social Forestry*.— objective, scope and necessity, evolution of social forestry in India, people participation, experiences of Social Forestry Projects in India.

1.2 *Agro-forestry*.— Scope and necessity, place of Agro forestry. in National Forest Policy, role in the life of people and domestic animals and integrated land use, planning especially related to, (i) soil and water conservation, (ii) water recharge, (iii) nutrient availability to crops; (iv) nature and eco-system preservation including ecological balances through pest-predator relationships and (v) providing opportunities for enhancing biodiversity medicinal and other flora and fauna. Agro forestry systems under different agro-ecological zones; selection of species and role of multipurpose trees - and HTFPs, techniques, 'food, fodder and feul' security. Research and Extension needs, social forestry in Himachal Pradesh, Van Mahotsava and Chipko movement.

1.3 *Farm Forestry*.—definition, its rembhlnce and difference from agro-forestry, farm wood lots. High-density plantations. Economics of farm forestry. Different farm forestry systems- tagunya, shifting cultivation, alley cropping, wind braks, shelterbelts, dry land and wetland farm forestry.

1.4 *Tribology*.—tribal scene in India, concept of races, principles of social . grouping, stages of tribal economy, education, cultural tradition, customs, ethos and participation in forestry programmes with special reference to Himachal Pradesh.

2. *Joint Forest Management*.—Need, principles, objectives, methodology, scope, benefits and role of NGOs, mahila mandals and other voluntary organizations, details of steps involved such as formation of Village Forest Committees, Joint Forest Participatory Management committees.

3. *Forest Resources and Utilization*.—Environmentally sound forest harvesting practices logging and extraction techniques and principles, transportation systems. Storage and sale, Non-Timber forest Products (NTFPs) definition and scope.

Need and importance of wood seasoning and preservation; general principles of seasoning air and kiln seasoning, solar dehumidification; steam heated and electrical kilns. Composite wood; adhesives-manufacture, properties, uses, plywood manufacture-properties, uses, fibre boards-manufacture properties, uses; particle boards manufacture properties uses. Present status of composite wood industry in India in future expansion plans. Pulp-paper and rayon; present position of supply of raw material to industry, wood substitution, utilization of plantation wood; problems and possibilities.

Anatomical structure of wood, defects and abnormalities of wood, timber identification general principles.

4. *Non-timber Forest Products*.—Introduction, fodder, grasses and tree leaves, canes and bamboos, and their uses, methods of collection of Non-timber forest Products (NTFPs). Essentials Oils,

extraction classification, storage and uses. Non-essential oils-nature, occurrence, methods of-extraction of oils from seeds, Important oil yielding trees. Gums and Resins-sources, collection and uses, the occurrence and origin of gums in plants, properties of gums, important Indian gums, uses of gums, resins and oleoresins, formation of resins in plants, classification of resins, Tans, and Dyes-nature and kinds of tannins. Dyes-classification and sources of dyes, Beedi leaves, sources, collection and processing, Fibres and Flosses, Cutch and Katha- sources, extraction and uses, Drugs. Spices, poisons and Bio-pesticides.

5. *Marketing and Trade of Forest Produce.*— Basic concepts of demand, supply of forest produce, demand, demand and supply schedules, types of markets for timber and non-timber forest produce, market locations of timber and non-timber forest produce and their features. Demand forecasts.

Price determination in timber and non-timber forest produce, Economic features of specialized markets in terms of degree and type of competition in buying and selling, price spread, costs of marketing functions involved like pre-commercial thinning, commercial thinning, harvesting, hauling, sawing, transportation, treatment of wood, carpentry, and other processing activities involves in teakwood, rosewood, matchwood, pulpwood, sandalwood, veneers- type and degree of competition in market for services of saw mill and other intermediate wood processing industries, price spreads across different channels of marketing. Economic features of specialized markets in terms of degree and Type of competition for bamboo, canes, lacs, gums, resins, hides and skins forest based medicinal plants and trees and and other non-timber forest products.

Economics of gathering medicinal plants from forests. Economics of processing medicinal plants.

Domestic demand and trade in timber and non-timber forest products.

International demand and trade in timber and non-timber forest product. Market efficiencies in timber, non-timber forest product and measures to check the efficiencies.

## SECTION-B:

5. *Forest Soils, Soil Conservation.*— Forest Soil'; classification, factors affecting soil formation; physical, chemical and biological properties. Soil Conservation - definition causes for erosion; types- wind and water erosion; conservation and management of eroded soils/areas, wind breaks, shelter belts; sand dunes; reclamation of saline and alkaline soils, water logged and other waste lands. Role of Forests in conserving soils organic matter, provisions of Lopping for green leaf manuring; forest leaf litter and composting; Role of microorganisms in ameliorating soils; Nand C cycles, VAM.

6. *Forest Economics.*— fundamental principles, cost-benefit analysis; estimation of demand and supply; analysis of trends in the national and international market and' changes in production and consumption patterns; assessment and projection of market structures; role of private sector and co-operatives; role of corporate financing. Socio-economic analyses of forest productivity and attitudes; valuation of forest goods and service.

7. *Forest Policy & Legislation.*— Policy definition, necessity and scope. Legal and institutional approaches to forest resource management. National Forest Policies. Forest Law- Legal definition. Objects of special forest law. Indian Forest Act. Detailed study of IF A, 1927. H.P. State Forest Acts and Rules. History of forest development; Indian Forest Policy of 1894. 1952 and 1990. National Forest Policy, 1988 of people's involvement, Joint Forest management, involvement of women; Forestry-Policies and issues related to land use, timber and non-timber products sustainable forest management; industrialization policies; institutional and structural changes. Decentralization and Forestry Public Administration. Forest laws, necessity, general principles, Indian Forest Act, 1927; Forest Conservation Act, 1980; Wildlife Protection Act, 1972 and their amendments; Application of Indian Penal Code to Forestry Scope and objectives of



Forest inventory. History of Forest Development in India, Forest Policy of 1894, 1952 and amendment of 1988. Forest Law- its necessity. Indian Forest Act, 1927; Forest Conservation Act, 1980.

8. *Extension & Education*.— meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry extension process, principles and selected programmes, ICFRE and its institutes and its institutes. People's participation in forestry programmes, motivation of women community, children, youth and voluntary organizations for forestry extension work. Rural Development- meaning, definition, objective and genesis. Transfer of technology programmes like ORP, ILP, NID, FLD, KUK, TARP etc. of ICAR.

9. *Communication*.— meaning, definition, elements & selected models. Audio-visual aids- meaning, importance, classification and selection. Programme planning process meaning, scope, principles and steps. Evaluation- meaning, importance and methods. Score and importance of PRA & RRA. Management and administration- meaning, definition, principles and functions. Concepts of human resource development (HRD) Rural leadership.

10. *Project Planning, monitoring & evaluation*.— Needs, scope and types of Projects, project methodology, components and cycle, stages of project formulations, project budgeting, sensitivity analysis, cost benefit ratio and analysis, need for project monitoring and evaluation, M&E techniques and methodology.

## GEOLOGY

### SECTION-A:

*Physical Geology and geomorphology*.— Origin, structure, interior and age of the Earth Geosynclines and Mountains. Isostasy. Origin of continents and oceans. Continental drift. Seismology, Volcanology, Geological action of surface agencies.

*Structural and field geology*.— Common structure of igneous, sedimentary and metamorphic rocks, study of folds, faults, unconformities, joints and thrusts. Elementary Ideas of methods of geological surveying and mapping.

*Stratigraphy and Palaeontology*.— Principles of Stratigraphy. Indian Stratigraphy. Lithological and Chronological sub-division of Geological record. Fossils, nature and its mode of preservation, bearing or organic evolution. Invertebrate and plant fossils.

### SECTION-B:

*Crystallography and Mineralogy*.—Elements of crystal forms and symmetry. Laws of Crystallography, Crystal systems and classes. Crystal habits. Twinning, Stereographic projections. Physical, chemical and optical properties of minerals, study of more important rock-forming and economic minerals regarding their chemical, physical properties, crystallographic and optical characters, alterations, occurrence and commercial uses.

*Economic Geology*.—Theories of ore genesis. Classification, geology, occurrence, localities and resources of chief metallic and non-metallic minerals of India, Mineral industries in India. Principles of geophysical prospecting and ore dressing.

*Petrology*.— Origin, constitution, structure and classification of igneous, sedimentary and metamorphic rocks. Study of common Indian rock types.

**HORTICULTURE****SECTION-A:**

Fruit industry in India and its potential. General principles of cultivation. Method of propagation. Physiological basis of rooting. Special plant growing structures- mixed propagation, green house and glass house. Promising root stocks for fruit crops. Plant growth regulators, retardants and inhibitors relating to flowering, sex expression, fruit set, fruit development and ripening. Dormancy and rest and rest period. Pollination and fruit set. Growth and fruiting habits of fruits and new species. Parthenocarpy Orchard management practices, manure and manuring, irrigation, training and pruning high density planting. Fruit thinning and fruit drop.

Origin, history, pomological description climatic requirements and production techniques of important temperate, sub-tropical and tropical fruit crops. Important pests, diseases and physiological disorders and their management. Integrated management of pests and diseases. Harvesting and harvest maturity indices. Handling and marketing problems of major fruits. Special problems of production.

Principal methods of preservation. Important fruit and vegetable products. Processing techniques and equipment. Wastes from processing factory and their impact on environment. By-products and utilization. Nutritive value of fresh and processed fruits and vegetables. Standards of fruit and vegetable products.

Economic principles in fruit and vegetable production. Use of planning and budgeting techniques. Efficiency measures of orchard management.

Extension education and its importance. Methods of evaluation of extension programmes. Socio-economic survey and status of different categories of farmers. Training programmes for extension workers. Lab to field and T&V programmes.

**SECTION-B:**

Importance, nutritive value and classification of vegetables. Types of vegetable gardening. Principle of vegetables, cultivation including nursery management. Climatic requirement and cultivation of major summer and winter vegetable crops. Off season vegetable production. Diseases and pests of vegetable crops and measures to control. Weeds, their characteristics and association with various vegetable crops.

Principles of plant breeding in the improvement of major vegetable crops Methods of breeding of self, cross-pollinated and vegetatively propagated crops. Seeds technology and its importance. Production processing, testing and marketing of vegetable seeds.

Plant physiology and its significance. Growth and development factors affecting growth. Absorption and translocation of water transpiration and water economy. Modern concepts of photosynthesis and respiration.

Processes and factors of soil formation. Mineral and organic constituents of soil and their role in maintaining soil productivity. Plant nutrient elements in soils and their availability. Nitrogenous, phosphatic potassic and micronutrient fertilizers and their use. Problem soils and their reclamation. Water conservation and watershed management. Water use efficiency in relation to crop production. Criteria for scheduling irrigation, ways and means of reducing run off losses.

Importance and scope of floriculture, landscaping and interior-scaping. History, theory and principles of landscape, planting and lawns. Beautification of slopes, forests and wastelands. Layout of home gardens

and public parks. Propagation of ornamentals. Cultural requirement of ornamental trees, shrubs, climbers, bulbs and annuals for winter and summer season. Production technology and post harvest management of cut flowers bulbs, house plants and breeding plants.

## MATHEMATICS

### SECTION-A:

#### MATHEMATICS PURE

(a) *Algebra*.— Sets, Union, intersection difference and complementation properties, Venn Diagram. Properties of natural numbers. Real numbers and their representation by decimals. Complex number, Argand Diagram. Cartesian Product Relation. Mapping. Function as a mapping. Equivalence relation. Groups, Isomorphism or groups. Sub-groups, Normal sub-groups, Lagrange's theorem. Frobenius theorem.

The definitions and illustrations of rings and field. Divisors of zero and Homomorphisms. Vector spaces.

Determinants addition, subtraction, multiplication and inversion of matrix. Linear homogeneous and non-homogeneous equations, Cayley Hamilton theorem.

Elementary number theory. Fundamental theorem of arithmetic. Congruences. Theorems of Fermat and Wilson. Inequalities. Arithmetical and Geometrical means. Inequalities of Cauchy, Schwarz, Holder and Minkowsky.

(2) *Infinite sequences and series*.— Concepts of limit infinite series. Convergent, divergent and oscillatory series. Cauchy's general principles of convergence. Comparison and ratio test. Gauss's test. Absolute convergence and rearrangements of series.

(3) *Trigonometry*.— De Moivre's theorem for rational index and its applications. Inverse, Circular and Hyperbolic functions. Expansions and summation of trigonometrical series. Expressions for sine and cosine in terms, of infinite products.

(4) *Theory of Equation*.— General properties of polynomial equation. Transformation of equations. Nature of the roots of cubic and biquadratic. Cardan's solution of the cubic, Resolution of biquadratic into quadratic factors. Location of roots and Newton's method of divisors.

(5) *Analytic Geometry of two and three dimensions*.— Straight lines. Pair of straight lines, circle, system of circle. Ellipse Parabola, Hyperbola, Reduction of second degree equation to a standard form. Plane, straight lines, sphere, cone, conoids and their tangent and normal properties (Vector methods will be permissible).

(6) *Analysis*.— Concept of limit, continuity, derivation, differentiability of a function of one real variable, properties of continuous functions. Characterisation of discontinuities. Mean value theorems. Evaluation of indeterminate forms. Taylor's and Maclaurin's theorems with L'Hôpital's and Cauchy's form of remainders. Maxima and minima of function of one variable. Plane curves, singular points, curvature curve tracing Envelopes, Partial differentiation. Differentiability of function of more than one real variable. Standard methods of integration. Riemann's definition of definite integral of Continuous function. Fundamental theorem of integral calculus. First mean value of theorem of integral calculus. Rectification, quadrature volumes and surfaces of solids of revolution and their applications.

(7) *Differential Equation*.— Formation of ordinary differential equation order and degree. Geometrical demonstration of the existing theorem for  $dx/dy = S(x,y)$ . First order linear and non-linear equations. Singular points. Singular solutions. Linear differential equations and their important properties. Linear differential equations with constant co-efficients. Cauchy-Euler type of equations. Exact differential equations and equations admitting integrating factor. Second order equations. Changing of dependent and independent variables. Solution when integral is known variation of parameters.

## SECTION-B:

### MATHEMATIC APPLIED

(1) *Vector Analysis*.— Vector Algebra, Differentiation of Vector function of a scalar variable. Gradient Divergence and Curl in Cartesian, cylindrical and spherical coordinates and their physical interpretation. Higher order derivatives. Vector identities and Vector equations. Gauss and Stokes theorems.

(2) *Static*.— Fundamental laws of Newtonian Mechanics. Theory of Dimension. Plan Statics. Equilibrium of system of particles. Work and potential energy, Centre of mass and centre of gravity. Frictions, common catenary, Principle of virtual work. Stability of equilibrium. Equilibrium of forces in three dimensions.

Attraction potential of rods, rectangular and circular discs, spherical shell, spherical equipotential surfaces and their properties. Properties of potentials. Gauss equivalent stratum. Laplace's and Poisson's equations.

(3) *Dynamics*.— Velocity vector, Relative velocity. Acceleration. Angular velocity. Degrees of freedom and constraints. Rectilinear motions. Simple harmonic motion. Motion in a plane. Projectiles. Constrained motion. Work and energy. Motion under impulsive forces. Kepler's laws, Orbits under central forces. Motion of varying mass. Motion under resistance. Moments and products of inertia. Two dimensional motion of a rigid body under finite and impulsive forces. Compound pendulum.

(4) *Hydrostatics*.— Pressure of heavy fluids, Equilibrium of fluids under given system of forces. Centre of pressure. Thrust on curved surfaces. Equilibrium of floating bodies. Stability of equilibrium. Pressure of gases and problems relating to atmosphere.

### MECHANICAL ENGINEERING

## SECTION-A:

*Statics*.— Equilibrium in three dimensions. Suspension cables. Principles of virtual work.

*Dynamics*.— Relative motion, Coriolis force, Motion of a rigid body Gyroscopic motion. Impulse.

*Theory of Machines*.— Higher and lower pairs, inversions, steering mechanism, Hooke's joint, velocity and acceleration of lines, inertia forces. Cams. Conjugate action in gearing and interference, gear trains, epicyclic gear. Clutches, belt drives brakes, dynamometers, fly wheels, governors, balancing of rotating and reciprocating masses and multicylinder engines. Free, forced and damped vibration for a single degree of freedom. Degrees of freedom. Critical speed and whirling of shafts.

*Mechanics of Solids*.— Stress and strain in two dimension. Mohr's Circle. Theories of failure, deflection of beams, buckling of columns, combined bending and torsion. Castigliano's theorem. Thick cylinders, rotating disk. Shrink fit. Thermal stress.

*Manufacturing science*.— Merchant's theory, Taylor's equation. Machineability. Unconventional machining methods including EDM, ECM and ultrasonic machining. Use of lasers and plasmas. Analysis of forming processes. High velocity forming Explosive forming. Surface roughness, gauging, compactors, jigs and fixtures.

*Production Management.*—Work simplification, work sampling, value engineering. Line balancing, work station design storage space requirement ABC analysis. Economic order, quantity including finite production rate, Graphical and simplex methods for linear programming; transportation model; elementary queuing theory. Quality control and its uses in product design. Use of X.R.P. and charts, single sampling plans, operating characteristics curves. Average sample size, Regression analysis.

#### SECTION-B:

*Thermodynamics.*—Applications of the first and second laws of thermodynamics. Detailed analysis of thermodynamic cycles.

*Fluid Mechanics.*—Continuity, momentum and energy equations. Velocity distribution in laminar and turbulent flow, dimensional analysis. Boundary layer on a flat plate. Adiabatic and isentropic flow, Mach number.

*Heat Transfer.*—Critical thickness of insulation. Conduction in the presence of heat sources and sinks. Heat transfer from fins. One dimensional unsteady conduction. Time constant for thermocouples, Momentum and energy equations of boundary layers on a flat plate. Dimensionless numbers. Free and forced convection, boiling and Condensation Nature of radiant heat. Stefan Boltzmann law. Configuration factor, logarithmic mean temperature difference. Heat exchanger effectiveness and number of transfer units.

*Energy Conversion.*—Combustion phenomenon in C.I. and S.I. engines. Carburation and fuel injection, selection of pumps, classification of hydraulic turbines, specific speed Performances of compressors. Analysis of steam and gas turbines. High pressure boilers. Unconventional power systems including Nuclear power and MHD systems. Utilisation of solar energy.

*Environmental Control.*—Vapour compression, absorption, steam jet and air refrigeration system. Properties and characteristics of important refrigerants. Use of psychometric chart and comfort chart. Estimation of cooling and heating loads. Calculations of supply air state rate. Air conditioning plant layout.

### PHYSICS

#### SECTION-A:

*Mechanics.*—Galileans, Transformation, concept of mass and Newton's laws of motion conservation laws, Motion of rigid bodies. Coriolis forces, Kepler's laws of gravitation, measurement of 'F' of Artificial satellites. Fluid motion, Bernoulli's theorem, circulation, Reynold number, turbulence Viscosity, surface tension. Elasticity. Relativistic mechanics and simple applications, elements of general relativity.

*Thermal Physics.*—Perfect gas, Vander Waals equations. Laws of Thermodynamics. Production and measurement of low temperatures. Kinetic theory of gases; Brownian motion. Black body radiation. Planck's law. Specific heat of gases and solids. Thermionic emission. Fermi Dirac and Bose-Einstein distribution laws. Thermal ionization. Elements of irreversible thermodynamics. Solar energy and its utilization.

*Waves and Oscillations.*—Oscillations with one and two degree of freedom, forced vibrations and resonance wave motion. Phase and group velocity.

Huygen's Principles, Reflection, refraction. Interference, diffraction and polarization of waves, Optical instruments and resolving powers. Multiple beam interference Ex-M. wave equation, Fresnel's formula, normal and anomalous dispersion coherence. Laser and its application.

## SECTION-II

Poisson's and Laplace's equations and simple applications. Dielectric and polarization, capacitors. Dia-param and ferromagnetic materials. Kirchhoff's laws. Amperes law, Faradays laws of electromagnetic induction L.C.R. circuits, alternating currents, Maxwell's equations.

*Atomic Physics* - Bohr's theory, Electron spin, Lande's factor. Pauli's principles. Spectre of one electron system. Zeeman effect, wave particle. Elements of X-ray spectra. Compton scattering. Wave particle duality, Schrodinger's equation and simple applications. Uncertainty principles.

Basic properties and structure of nuclei, mass spectrometry, radio activity, mechanism, band and decay, properties of neutron, electron microscope, nuclear fission and reactor, nuclear fusion, cosmic ray showers, pair production. Simple properties of elementary particles. Symmetry in physical laws.

*Electronics*. Electron emission from solid, Child-langmuir Law, Static and dynamic characteristics of diodes, triodes, torodes and pentodes, thyatron. Band structure of metals and semiconductor s, doped semi-conductors, P-N diodes, transistor;

Simple (vacuum tubes and transistor) circuits for Rectification, amplification, oscillation, modulation and detection of r.f.waves. Basic principles of radio reception and transmission. Television. Elementary principles of microscope solid state device.

## PLANT AND GENETICS AND BREEDING

**Element of Genetics.**— Review of mendelian genetics; NDA Structure, replication and concept of central dogma, molecular organization of chromosomes and their replication, polyploidy and aneuploidy; mutation and its molecular basis, introduction to quantitative genetics, extra-nuclear genome; concepts in genetic engineering.

*Principles of Plant Breeding.*— Introduction to plant breeding, centres of origin and domestication, plant introduction, conservation and acclimatization, modes of reproduction and pollination control, qualitative and quantitative characters, genetic structure of self, cross and vegetatively propagated plants, selection in self-pollinated crops, hybridation-techniques and consequences; selection in cross pollinated crops, heterosis breeding; mass selection, pure line selection, pedigree methods, bulk method, single seed descent, backcross methods, multi line approach, population improvement and recurrent selection; hybrids and synthetics, breeding vegetatively propagated crops breeding for biotic and abiotic stress resistance; mutation and polyploidy breeding, distant hybridization, biotechnology in crop improvement- transgenic plants, national and international institutes for crop improvement.

*Breeding of Field Crops.*— Origin, geographical distribution, economic attributes and major breeding objectives of crop plants, viz. cereals- millets, pseudo cereals, pulses, oilseeds, forage crops, sugar-yielding crops and fibre crops, novel breeding techniques and methods, accomplishments in crop improvement, future strategy with special reference to work done in India and abroad

*Principles of Seed Technology.*— Importance of quality seed, introduction to seed industry; seed programmes and their growth, reproductive systems in crop plants, classes of seed; generation of breeder seed, foundation seed and certified seed, influence of agro-climatic factors on seed yield and quality; selection of seed production areas, genetic purity- its deterioration and maintenance, principles and methods of seed production in Self and cross pollinated crops, principles and methods of seed production in vegetatively

propagated crops;harvesting and seed extraction of specific vegetable crops seed maturity, harvesting, threshing and other post harvesting techniques, principles of seed processing including seed drying, cleaning, packaging and storage release and notification of varieties, seed certification- field standards and minimum seed certification standards; seed legislation, seed testing for purity, germination, viability, vigour, moisture and health- ISTA rules, seed storage- factors influencing seed certification standards; seed legislation; seed testing for purity, germination, viability, vigour, moisture and health- ISTA rules, seed storage- factors influencing seed quality and storability.

## PLANT PATHOLOGY

*Introductory Plant Pathology.* - Importance and brief history of plant pathology, terminology, concept, causes and classification of plant disease, symptomatology, stages in disease development, dissemination of pathogens; inoculum and inoculum potential; Pathogenesis- role of toxins and enzymes; variability in pathogens; disease resistance, plant disease epidemics; disease forecasting; management of diseases through regulatory, cultural, physical, chemical and biological methods, integrated disease management biotechnology in plant pathology.

*Mushroom Cultivation.* - Introduction, infrastructure, cultivation of Agaricus and Pleurotus, preparation of compost and casing soil, spawn production, spawning and Spawn run; causing, maintenance of temperature, relative humidity, aeration and hygienic conditions, cropping and harvesting, packing and preservation, management of pests, pathogens and competitors, economics of mushroom cultivation; visit to a private mushroom house.

*Crop Diseases and their Management.* -Symptoms, etiology and management practices ( integrated disease management through chemicals, host plant resistance, cultural practices and biological methods (for disease of rice (blast, brown spot, false smut, bacterial blight, tungro and Khaira disease) maize (leaf spots, blights, smuts and stalk rots); sorghum(downy mildew, ergot and smut) Bajra (downy mildew, and ergot), frenchbean) anthracnose, angular leaf spot, floury leaf spot, bacterial blight blight and mosaics), urd and mungbean (leaf spots, crinkle and yellow mosaic), soybean (brown spot, bacterial pustule and pod rot), groundnut (tika disease, and rust), sesamum (phyllody), potato (early and late blight, scurf, common scab, wart, mosaics, leaf roll and bacterial wilt) tomato (buckeye rot, wilt and leaf curl), capsicum (fruit rot, wilt, blight and mosaic) brinjal (phomopsis blight and fruit rot, wilt and little leaf), cucurbits (root knot, mildews), onion (downy mildew and purple blotch), coriander (stem gall), coradmom (katte), apple (scab, root rot and cankers), citrus (canker, decline, die-back, greening and tristeza); stone fruits (fire blight, crown gall and gummosis), banana (panama wilt and bunchy top), tea (blister blight and red rust), coffee (rust), tobacco (black shank and mosaic), rubber (stem rot), coconut (cadang-cadang and phloem necrosis), tulip (bulb rot and blight) gladiolus (corm rot) carnation (Wilt and leaf spot) and liliun (bulb rot).

*Mushroom cultivation.* -Importance of Mushroom cultivation and its landmarks; infrastructure composting - long and short methods, spawn production; causing soils and its functions; management of environmental factors and mushroom production; harvesting, packing and conservation and preservation of mushroom; economics of mushroom production.

## PLANT ANATOMY

Ultra cell structure, cell wall, meristems, tissue and tissue system, primary and secondary xylem and phloem. Vascular cambium and periderm abscission, Internal structure of root, stem, leaf, fruit and seed Secondary growth, storage region in root and tuber crops-beets carrot, radish sweet potato and potato, Origin of lateral roots. Healing of wounds including graft union

**PRACTICAL :** Study of cell, tissue and organ by hand sectioning and maceration, Preparation of permanent slides, Study of prepared slides, Microtechniques.

## SOIL SCIENCE

*Fundamentals of soil science.*—Earth/Es crust and its composition, soil forming rocks, minerals and their weathering, factors of soil formation and soil forming processes, introduction to soil, soil profile, pedon and polypedon, soil classification and soil survey; soil as a medium for plant growth, soil composition, physical properties of soil-texture, structure, particle density, bulk density, colour and porosity; soil air and temperature, chemical properties of soil soil pH, exchange capacity, base saturation and buffering capacity, soil colloids- organic, inorganic and their properties, soil organic matter-its composition and properties, biological properties of soil flora and fauna, remote sensing application land resource studies.

*Irrigation Water Management.*—Significance of irrigation and its source, scheduling of irrigation, determination of quantum of irrigation water to be applied, water conveyance and control, estimation; of evapotranspiration; irrigation efficiencies, methods of irrigation, quality of irrigation water.

*Principles of Soil Physics and conservation.*—Importance of soil physics, soil separates, mass-volume relationships, soil water constants, soil water potential, movement of water in soil, infiltration, evapotranspiration, soil structure-aggregation and classification, soil air, soil temperature, soil consistency, soil and water conservation- problems and prospects, type of water and wind erosion; factors affecting soil erosion, vegetative and structural measures for soil conservation, integrated watershed management.

*Soil Fertility, Fertilisers and Integrated Nutrient Management.*—Concept of soil fertility and productivity; factors affecting plant growth and plant growth expression, essential plant nutrients-forms, functions and factors affecting their availability, various techniques employed for soil fertility evaluation soil colloids and their significance for plant growth, origin of charges, for exchange phenomena and buffering capacity, problem soils (acid, salinealkali) and salt affected- their characteristics, formation and management; organic manure and their role in soil fertility, nitrogenous, phosphoric and potassic fertilizers- their characteristics and usages secondary and micro-nutrient fertilizers, slow release fertilizers, bio-fertilizers, integrated nutrient management for sustainable agriculture.

*Soil Taxonomy, Soils survey and Remote Sensing.*— Introduction to soil survey, geographical information systems and remote sensing, soil profile and land forms remote sensing data products, geographical information systems and data bases, base maps, soil resource and collateral data, land capability classification, existing land use / land cover system; thematic maps, proposed land use land cover plan, action plan for sustainable land resource management.

## STATISTICS

### SECTION -A

(1) *Probability.*—Classical and statistical definitions of probability, Simple theorems of probability with examples. Conditional probability and statistical independence. Bayes's theorem. Random variables- Discrete and continuous. Probability function and probability density functions. Probability distribution in one or more varieties. Mathematical expectations. Chebyshev's inequality, weak-law of large numbers. Simple form of central limit therein.



(2) *Statistical methods.*—Compilation, classification, tabulation and diagrammatic representation of various types of statistical data.

Concepts of statistical population and frequency curve, measures of central tendency and dispersion, moments and cumulants. Measures of Skewness and Kurtosis. Moment generating functions Study of standard probability distributions. Binomial, Poisson, Hypergeometric, Normal, Negative, nominal rectangular and log normal distributions. General description of the Pearsenian system of curves.

General properties of a bivariate distributions, bivariate normal distribution. Measures of association and contingency, Correlation and Linear regression involving two or more variables. Correlation ratio, inter-class correlation. Bank correlation. Nonlinear regression analysis.

Curve fitting by methods of free hand curves, moving average's, group average, least squares and movements. Orthogonal polynomials and their uses.

(3) *Sampling distribution and Statistical inference.*—Random sample statistics, concepts of sampling distribution and standard error.

Derivation of sampling distribution of mean of independent normal varieties  $X^2T$  and F Statistics, their properties and uses. Derivation of sampling distributions of sample means, variances and correlation coefficient from a vicariate normal population. Derivation (in large samples) and uses. Pearsonian  $X^2$

(4) *Theory of Estimation.*—Requirements of a good estimates/unbiasedness, consistency, efficiency and sufficiency. Cramer-Rao lower bound to variance of estimates. Best linear unbiased estimates.

Methods of estimation, General descriptions of the methods of moments, Methods of maximum likelihood methods, of least squares and method of minimum  $X^2$  properties of maximum likelihood estimators (without proof). Theory of confidence intervals, sample problems of setting confidence limits.

## SECTION-B:

*Theory of testing of hypotheses.*—simple and composite hypothesis. Statistical test and critical region. Two kinds of errors, level of significance and power of test.

Optimum critical region of simple hypotheses concerning one parameter. Construction of such region for simple hypotheses relating to a normal population.

*Likelihood ratio test.*—Tests involving mean, variance, correlation and regression coefficient in univariable and bi-variate normal population. Simple non parametric tests sign, run median rank and randomisation test.

Sequential test of a simple hypotheses against a simple alternative (without derivation)

(I) *Sampling techniques.*—Sampling versus complete enumeration. Principles of sampling. Frames and sampling units. Sampling and non-sampling errors. Simple random sampling. Stratified sampling. Cluster sampling. Systematic sampling. Description of multi-stage and multi phase sampling.

Ratio and regression methods of estimation. Designing of sampling surveys with reference to recent large—scale surveys in India.

(II) Design of experiments- Analysis of variance and covariance with equal number of observations in the cells.

Transformation of variate to stabilise variance.

Principles of experimental designs. Completely Randomised, randomized block and Latin square design Missing plot techniques. Factorial experiments with confounding in 2 s(s = 2(i), 32 designs .Split plot design. Balanced incomplete design and simple lattice.

## ZOOLOGY

### SECTION

#### (NON CHORDATE AND CHORDATE)

1. A general survey , classification and relationship of various phyla.
2. Protozoa- Study of structure, life history of Paramaecium, Vorticella, Monocytis, Malarial Parasite, Euglena, Trypanosoma
3. Porifera- Study of Structure of cycon, canal system and skeleton in porifera.
4. Coelenterata-Obelia, Aurelia (Structure and Life History), polymorphism in Hydrozoa, coral formation, metagenesis.
5. *Helminthes*.—Planaria, *siola*, Taenia, Ascaris)Structure and Life History) Parasitism and Parasitic adaptation, Evolution of Parasitism .Helminths in relation to man.
6. *Annelida*.— Neries, Earthworm, Leech .)detailed history)
7. Arthropoda- Palaemon,Scorpion,Cockroach,Crustacean Larvae, Economic importance of insects
8. Mollusca- Unio, Pila, Torsion, and detossion in Gastropoda
9. Echinodermata- Starfish, larval form of Echinodermata.
10. Structure and bionomics and classification of the following Balanoglossus, Herdmania, Branchiostoma/Schliodon, Frog, Uromastex, Pigeon, Rabbit.
11. Comparative account of the various systems of a vertebrate(Digestive system,Respiratory system, Nervous system, Receptor system, Circulatory system Urinogenital system.
12. Retrogressive Metamorphosis, Colclom in Branchio tama.

SECTION-B :

**Cell Biology Cytogenetics, Animal Physiology, Evolution,  
Embryology and Histology**

1. *Cell Biology*.— Cell theory, structure and function of cell and cyto-plasmic constituents, structure of Plasma Membrane, Endoplasmic reticulum, Golgi Bodies, Mitochondria, Ribosomes, Nucleus, Cell division-Mitosis and Meiosis Gene structure and functions, Watson and Crick Model of DNA replication of DNA.

2. *Cytogenetics*.— Mendelian Laws of inheritance, recombination, multiple alleles, Mutation-Natural and induced Polyploidy. Sex determination, cytoplasmic inheritance.

3. *Physiology*.— Chemical composition of proto plasms. Animal Physiology, Digestion and Absorption, Respiration (including Cell Respiration) kidney and physiology and excretion. Physiology of nerve's impulse; Physiology of muscular contraction, Physiology of endocrine glands, Physiology of osmoregulation.

4. *Evolution*.—Origin of life, history of evolutionary thought. Evidences of evolution) Anatomical, embryological, comparative physiology evidence for geographical distribution, palaeontological evidence). Theories of evolution-Lamarckism, Neolamarckism. Darwinism, New Darwinism, Hardy-Weinberg law.

5. *Embryology and Histology*.— Gametogenesis, fertilization, types of eggs, cleavage, development upto gastrulation in Branchiostoma, Frog and Chick Fate maps of frog and chick, Metamorphosis in Frog, Formation and fate of extra embryonic membranes in chick; formation of amnion, allantois, and types of placenta in Mammal.

Histology of the following Tissues and Organisms of Mammals.

Epithelial Tissue, Connective tissue (connective tissue proper, cartilage, bone, blood and lymph) Muscular tissue and nervous tissue.

Histology of skin, stomach intestine, liver pancreas, lung, kidney, testis, ovary, spleen.

**GEOGRAPHY**

**PART-I**

Physical and Human Geography of the world. Principles of Physical Geography comprising of detailed study of the lithosphere, hydrosphere and atmosphere leading upto the modern views regarding cycle concepts isostasy processes of mountain formation, weather phenomena surface and sub-surface movement of ocean-water etc.

Principles of Human Geography comprising of detailed study of the distribution of man on the basis of cultures, race, religion etc. environment and mode of life. population trends and population movements.

**PART-II****PHYSICAL, ECONOMIC AND REGIONAL GEOGRAPHY OF INDIA**

- (i) Structure, relief, climate and soils.
- (ii) +Population and its problems.
- (iii) Agriculture, agrarian problems and programmes.
- (iv) Irrigation and River Valley Projects.
- (v) Power and Mineral Resources.
- (vi) Industries and industrial development of India under the plans, regions of India, basis of the division. A study of the regional divisions.